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# SIR EDWARD COKE.

It has often been observed, that the biography of those men who have enlightened or entertained the world by their writings, is barren of incident, and devoid of interest. But this, like all other general remarks, is subject to many exceptions. Besides the numerous instances of authors, whose lives have been chequered with variety of adventure, and frequent change of fortune, history, both ancient and modern, furnishes abundant examples of illustrious philosophers, and poets, and historians, who, while their leisure moments have been devoted to study, have nevertheless borne an active and a conspicuous part in the passing events of their time. As the life of every one who has taken a share in public affairs, must necessarily partake in a great degree of the interest attached to whatever is connected with them; and as it has almost invariably happened, that the most eminent individuals in every department of literature and science have flourished during periods the most pregnant with important or extraordinary circumstances, the biography of such of them as have stood forward on the stage of public life can seldom fail to be both interesting and instructive. The life of the great lawyer who is the subject of the following memoir, is an instance corroborative of this observation. The profession to which he devoted himself is one that, in this country, generally obliges those who attain very considerable eminence in it, to occupy a conspicuous station in the political community; and the exercise of their public duties is for the most part connected with those most important of all objects, the civil liberties, the rights and immunities of their countrymen. The period during which he lived, comprises the greater part of the reign of Elizabeth; the whole reign of James I; and part of that of Charles I; a space of time peculiarly memorable in the history of the English constitution, since during its continuance the prerogative of the crown was exerted and enforced with that intemperate want of forbearance, which afterwards caused its complete overthrow. These circumstances are sufficient to compensate for the want of personal incident and adventure.

Edward Coke was the descendant of an ancient and honourable family of Norfolk. He was born at Mileham, in that county; (1550;) and his father, who was himself a barrister of some eminence, dying while he was still young, he was at an early age left heir to a considerable fortune. Fortunately, however, his wealth did not eventually prevent him from embarking in the same honourable but laborious profession his parent had adopted. The bar was at that time considered, much more so than it is at present, a pursuit peculiarly adapted to the aristocracy; and whether there were more of ambition or of assiduity among their youth than they have been wont to display of late years, it certainly was then by no means uncommon to find men born to the enjoyment of ample fortunes devoting themselves to the study and the practice of the law, with no less zeal and perseverance than the keenest necessity could have stimulated them to exercise.

Coke was not poor, but he possessed a mind capable of the closest application, and ambition to render him assiduous in any pursuit that held out to him hopes of honour and preferment.

It is unnecessary to dwell on the particulars of Coke's education, as it does not appear that he was distinguished for any of the precocity of talent, or that his boyhood was attended with any of those uncommon circumstances, which sometimes give celebrity to the early years of remarkable men. After remaining a sufficient time at the free school of Norwich, where he had been sent at the age of ten years, he became a member of Trinity College, Cambridge, about the same time that the celebrated Doctor Whitgift was appointed master. There he resided during nearly four years; and having taken the degree of bachelor of arts, he afterwards proceeded to London for the purpose of studying the law as a profession. According to the general custom of that time, which required a student to go through a noviciate of some length in one of the inns of Chancery, previous to his admission as a member of either of the great inns of court, Coke was first enrolled among the students of Clifford's Inn, before his name was entered on the books of the Inner Temple.

Here he shortly distinguished himself by his assiduity and his rapid proficiency in study, which the frequent mootings and other academical exercises then practised in the inns of court gave him an opportunity of displaying to his seniors. Such public lectures and examinations, besides being capable of affording some assistance to those who were thrown without a guide among the intricacies of an abstruse study, had the advantage of bringing into notice many whose professional attainments might otherwise long have remained unknown. They have now for many years past been discontinued. Lord Keeper Guildford being represented by his entertaining biographer, Roger North, as the last person who regarded them in any other light than that of antiquated ceremonies; and, indeed, it appears, that even in Coke's time they were beginning to be much neglected; though this is a circumstance that he often laments in his writings.

It is much to be regretted that we have no detailed account of Coke's early studies in his profession; but we may gather from his occasional remarks on the subject, that he considered the time a young lawyer devoted to his profession might be best divided between attendance on the courts, or public lectures, and private reading. "I would advise our student," he says in one place, "that when he shall be enabled and armed to set upon the year bookes, or reports of law, that he be furnished with all the whole course of the law, that when he heareth a case vouched and applyed either in Westminster Hall, (where it is necessary for him to be a diligent hearer, and observer of cases of law,) or at readings or other exercises of learning, he may finde out and read the case so vouched; for that will both fasten it in his memory, and be to him as good as an exposition of that case. But that must not hinder his timely and orderly reading, which (all excuses set apart) he must bind himselfe unto; for there be two things to be avoyded by him, as enemies to learning, *præpostera lectio* and *præpropera praxis*." It is to be supposed that it was thus he himself acquired that fund of legal knowledge, for which he was remarkable even while he continued a student. In this capacity he remained during six years; after which time, in consideration of his great proficiency in the law, he was permitted to be called to the bar, though the usual period of probation was then eight years. The flattering compliment thus paid by the heads of his profession to his learning and talents was of itself a sufficient recommendation to ensure him early opportunities for bringing himself further into notice. Accordingly we find him engaged as counsel in a case of some importance so early as 1578, that is, in the twenty-eighth year of his age. He was also appointed reader or lecturer at Lyon's Inn, an office which he held during three years; and his readings, (which were not given, as it is usual to give them at present, merely for the sake of observing an antiquated form,) were so assiduously attended, and so generally admired, that he rapidly attained a degree of repute much greater than that of any other barrister of the same age and standing at the bar. His practice, in consequence, daily increased; and he was at length retained as counsel in almost every cause of importance that was tried in Westminster Hall. He became recorder of the cities of Norwich and Coventry, then solicitor to the queen, and afterwards attorney-general. His career was equally successful in parliament. He was returned by the freeholders of Norfolk as knight of the shire; and in 1592 was made speaker of the House of Commons.

The increase of his fortune, which, it has been already mentioned, was originally considerable, more than kept pace with his preferment. Soon after he had been called to the bar, he had contracted a marriage with a lady of the ancient and highly connected family of the Paston's; and he received with her a fortune, such as was considered at that time a very large one, no less a sum than thirty thousand pounds. After her death, which occurred while he was attorney-general, he formed another no less advantageous alliance (1598) with the daughter of the celebrated Lord Burleigh. This lady, who was the widow of Sir William Hatton, also brought him a considerable addition to his property, as well as to his consequence; but his marriage with her was not productive of domestic happiness. The celebration of the ceremony involved the parties in some difficulty. Notwithstanding the severity with which Archbishop Whitgift

had shown himself disposed to treat all those who were privy to marriages performed in an irregular manner, this had been solemnized in a private house, without a licence being previously obtained for the purpose; and notwithstanding the footing of acquaintance, if not of intimacy, on which that prelate stood with regard to the attorney-general, the act of contumacy was not passed over. A prosecution was instituted in the ecclesiastical court against all the parties concerned, among whom was Lord Burleigh himself. The consequences might have been serious, had the authority of the church been exerted to the utmost on the occasion; but it is probable that the suit was commenced merely for the sake of public example, and the penalties incurred were eventually remitted. It is curious to remark that the cause assigned for this lenity was, that the offence had been committed through ignorance of the law.

Meantime the professional duties of the attorney-general were prosecuted with unremitted attention; and it is supposed, that in addition to the functions which belonged to his office, he had other occupations to employ his attention in private, being frequently consulted by the queen's council in matters only indirectly connected with his public duties. But, notwithstanding the multiplicity of his avocations, he found time in 1600 to publish the first of the eleven parts of his Reports, the remainder of which were completed during the subsequent reign.

In the same year occurred the memorable trial of the Earls of Essex and Southampton, for high-treason. They had been guilty not only of conspiring against the government, but of actually exciting the citizens to revolt and insurrection, with the intent (as the indictment set forth) of compassing the queen's death. The case for the prosecution was, of course, conducted on the part of the crown by the attorney-general; but he acquired little credit by his conduct on the occasion. It is true that, according to the general practice of that time, state prisoners were commonly treated with a degree of harshness and severity quite incompatible with the just and benevolent axiom of the English law, which supposes every accused party innocent until the charges brought against him have been confirmed by a verdict. The person to be put on his trial was thrown into prison without the formality of an indictment. When confined, he was allowed neither pen, ink, nor paper; his friends and relations were denied access to him; and till the time of his appearing in court he remained in utter ignorance of every charge that was to be brought forward against him. He was not allowed to have any previous knowledge of the persons who were to compose the jury, though his right of challenging was almost the only privilege he was permitted to exercise; and whatever number of witnesses the crown might think proper to produce against him, he was not suffered to question them, or reply to their statements, until the whole case for the prosecution was closed. In short, the law treated the accused in every respect as though his conviction had already taken place, and he was unworthy to be considered other than a culprit. The formal proceedings in court were carried on in the same spirit. State trials were habitually conducted with a want of liberality, and even of decorum, towards those who were arraigned, which would be quite intolerable to the spirit and good taste of the present age. The counsel appointed to act on behalf of the crown seldom thought it necessary to appear, as if, in pressing their accusations against its enemies, they were reluctantly performing a painful duty; and far from endeavouring to mitigate by the mildness of their deportment the actual severity they were called upon to exercise, it was not unusual with them to aggravate it by expressions of personal hostility towards the prisoners on trial. The common prevalence of this practice might, perhaps, in some measure excuse (though it certainly cannot justify) Sir Edward Coke for conforming to it. But he carried this fault even farther than his contemporaries. In the prosecution of the Lords Essex and Southampton, whether from the natural violence and irritability of his temper, or from a desire of showing his obsequiousness to the queen by his treatment of her enemies, he behaved towards the two accused noblemen with a malignity and want of forbearance that not only tarnished his own reputation, but rather injured than strengthened the case which had been put into his hands. It is well known that the insurrection, which formed the chief ground of accusation against them, was too public and too notorious not to be fully capable of

being proved by the most unexceptionable testimony; yet Coke, not satisfied with the depositions of the witnesses, interrogated the accomplices of the treason, and even went so far as to examine the avowed enemy of the Earl of Essex, Sir Walter Raleigh, concerning what he had indirectly heard on the subject of the alleged conspiracy. Each of the peers, in his defence, alluded to the marked animosity which the attorney-general had displayed throughout the trial; and Lord Southampton, addressing him, said: "You urge the matter very far, and you wrong me therein; my blood be upon your head."

But violent and intemperate as was the bearing of Coke in prosecuting this charge, the manner in which he treated Sir Walter Raleigh on a similar occasion, reflects much greater disgrace on his character. The trial of that justly celebrated man took place in 1603, in the first year of the reign of James I. He was accused of high treason, in compassing and imagining to depose and destroy the king, and of treating with the Spanish government for assistance in the execution of his purpose. It is not necessary to enter into a detail either of the accusation or of the evidence that was adduced to support it. What foundation ever existed for the charge, it is now, as indeed it appeared at the time, to be impossible to ascertain; but at all events the testimony, by means of which Sir Walter was condemned, was entirely illegal. The only direct deposition that affected his innocence, was that of Lord Cobham, who was not openly produced in court as a witness, and who had made a solemn recantation of his former evidence. The law required that the accused party should not be convicted but on the testimony of two credible witnesses brought face to face; on this the prisoner insisted in his defence; but this clear and explicit rule of law was thought to give an inconvenient protection to the life and liberty of the subject, and was accordingly overruled through the influence of the attorney-general, who, however, could not, and did not attempt to show that the statutes, (5 and 6 Edward III. cap. 11,) by which it is expressly enacted that there shall be two witnesses in cases of high treason, had ever been repealed. He merely affirmed in general, that the law was altered; and endeavoured to account for the change, by declaring "that the crown could not stand a year upon the king his master's head, if a traitor could not be condemned by circumstances." By this corrupt and disgraceful artifice, Sir Edward Coke not only succeeded in procuring the condemnation of Raleigh, but furnished a precedent, by means of which at after periods many other persons accused of high treason were unjustly and unlawfully convicted. His deportment towards his illustrious victim during the trial, was not less derogatory to the dignity of his own office, than offensive to decorum, and even insulting to the court. He loaded this accomplished gentleman and scholar with abuse and scurrility; called him the most notorious traitor that ever came to the bar: a monster, a viper, a spider of hell, a damnable atheist, one who had an English face, but a Spanish heart; and carried the licence of speech, which the custom of that time in some degree authorized, to an extent that had never before been attempted. The calmness and self-possession of the accomplished individual to whom these epithets were applied, served to make the overbearing conduct of the attorney-general appear more odious by the contrast. The following specimen of a dialogue that took place between the accuser and the accused, places the difference in a sufficiently strong light. After calmly listening to a long strain of scurrility and invective, Sir Walter observed:

"You speak indiscreetly, barbarously, and uncivilly."

*Coke.* "I want words to express thy viperous treasons."

*Raleigh.* "I think you want words indeed; for you have spoken one thing half a dozen times."

*Coke.* "Thou art an odious fellow: thy name is hateful to all England for thy pride."

*Raleigh.* "It will go nigh to prove a measuring cast between you and me, Mr. Attorney."

The conduct of Sir Edward Coke throughout this trial must have been recollected by Bacon, when, at a later period, he observed to him: "As in your pleadings you were wont to insult over misery, and to inveigh bitterly at the persons, which bred you many enemies, whose poison yet swelleth, and the effects now appear; so you are still wont to be a little careless in this point, to praise or disgrace upon slight grounds, and that sometimes untruly,

so that your reproofs or commendations are for the most part neglected and condemned; when the censure of a judge, coming slow but sure, should be a brand to the guilty, and a crown to the virtuous. You will jest at any man in public, without respect of the person's dignity or your own: this disgraceth your gravity, more than it can advance the opinion of your wit; and so do all actions which we see you do directly with a touch of vain-glory, having no respect to the true end."

From the tenour of these remarks, which were addressed to Coke under the form of "an expostulation," it will be perceived that he was not upon terms of friendship with the illustrious personage who afterwards became Lord Chancellor. Though the want of amity between them may, no doubt, in some measure be attributed to the insolent and haughty bearing of the attorney-general, it must be admitted, that a feeling of jealousy, wholly unworthy of such a character as Bacon's is usually represented, was probably the chief cause of it. But, to whichever of the two the original wrong be imputed, it is certain that their dislike of each other shortly became mutual, and was at length increased to undisguised animosity. After the specimen which has been just given of the language employed by Coke, in the trial of Sir Walter Raleigh, it will not excite much surprise to find him on another occasion forgetful of decorum (at least as decorum is at present understood) towards his own personal enemy; and to perceive that the same ungovernable warmth of temper which he had before exhibited in so disgraceful a manner, should again give a calm opponent a decided advantage over him. Bacon has left among his works a short tract, entitled, "A true remembrance of the abuse I received of Mr. Attorney-General, publicly in the exchequer, the first day of term; for the truth whereof I refer myself to all that were present:" and if this document state the circumstances correctly, it will not be disputed that the attorney-general would, in every point of view, have done wisely if he had refrained from provoking such an adversary to an open contest.

Bacon, who was then at the bar, had occasion to move for the reseizure of some lands, "and this," says he, "I did in as gentle and reasonable terms as might be."

"Mr. Attorney kindled at it, and said: 'Mr. Bacon, if you have any tooth against me, pluck it out; for it will do you more hurt than all the teeth in your head will do you good.' I answered coldly in these very words: 'Mr. Attorney, I respect you; I fear you not; and the less you speak of your own greatness, the more I will think of it.'

"He replied: 'I think scorn to stand upon terms of greatness towards you, who are less than little; less than the least;' and other such strange light terms he gave me, with that insulting which cannot be expressed.

"Herewith stirred, yet I said no more but this: 'Mr. Attorney, do not oppress me so far; for I have been your better, and may be again, when it please the queen.'

"With this he spake, neither I nor himself could tell what, as if he had been born attorney-general; and in the end bade me not meddle with the queen's business, but with mine own; and that I was unsworn, etc. I told him, sworn or unsworn was all one to an honest man; and that I ever set my service first and myself second; and wished to God that he would do the like."

It was probably in reference to this quarrel that Bacon addressed the following letter to the attorney-general:

"I thought best, once for all, to let you know in plainness what I find of you, and what you shall find of me. You take to yourself a liberty to disgrace and disable my law, my experience, my discretion. What it pleaseth you I pray think of me; I am one that know both mine own wants and other men's, and it may be, perchance, that mine mend, when others stand at a stay. And surely I may not endure, in public place, to be wronged without repelling the same to my best advantage, to right myself. You are great, and therefore have the more enviers, which would be glad to have you paid at another's cost. Since the time I missed the solicitor's place, the rather I think by your means, I cannot expect that you and I shall ever serve as attorney and solicitor together; but either to serve with another at your remove, or to step into some other course; so as I am more free than ever I was from any reason of unworthy conforming myself to you, more than general good manners, or your particular good usage shall provoke; and if you had not been short-sighted

in your own fortune, as I think, you might have had more of me. But that time is passed. I write not this to show my friends what a brave letter I have written to Mr. Attorney; I have none of those humours. But that I have written is to a good end, that is, to the more decent carriage of my master's service, and to our particular better understanding one of another. This letter, if it shall be answered by you in deed, and not in word, I suppose it will not be worse for us both; else it is but a few lines lost, which for a much smaller matter I would have adventured."

It will be collected from these passages, that Bacon had been foiled in his endeavour to become solicitor-general; and that he attributed the disappointment of his expectations to the influence of the attorney-general. As this circumstance would, according to his own statement, have prevented him from holding the post of solicitor while Coke remained in his office, Bacon, who was always keenly alive to his own interest, suppressed his personal dislike of his enemy so far as to exert himself to procure his advancement. Previous to the trial of Sir Walter Raleigh, that is, almost immediately after the accession of James I., Coke had received the honour of knighthood; and it is to be supposed that the active exertions which he subsequently made (1605) in the prosecution of the persons connected with the gunpowder treason, had ingratiated him in the favour of that monarch. The zeal for the cause of the government, and the great professional knowledge which he displayed throughout the whole of the proceedings connected with the conspiracy, but particularly on the trial of the jesuit, Garnet, marked him as a fit subject for promotion. Accordingly in 1606, (having been previously admitted to the rank of serjeant at law,) he was appointed chief justice of the court of Common Pleas. The vacant place of attorney-general was at the same time filled by Sir Henry Hobart, and Bacon became solicitor.

Sir Edward Coke retained his situation of chief justice of the Common Pleas during upwards of seven years. It was a place for which his profound knowledge of the law eminently qualified him; and though he was, probably with justice, reproached for his haughty and unconciliating deportment on the bench, it appears that, upon the whole, the manner in which he acquitted himself of the duties of his office gained him the highest credit. Bacon, indeed, has accused him of making the law lean too much to his opinion, and using it as a double-edged weapon; but however his conduct in the prosecution of Sir Walter Raleigh may seem to justify such an imputation, there is certainly no proof of it on record, and the general charge, coming from such a quarter, cannot be entitled to implicit credit when unsupported by any corroborative testimony.

It does not appear that Sir Edward Coke ever expressed, or even entertained, a wish to be removed from the court of Common Pleas, unless indeed there might have been an opportunity of raising him to the Woolsack. But Bacon, who was high in favour at court, had his own reasons for wishing that his enemy should be preferred to the chief justiceship of the King's Bench, as by this change Sir Henry Hobart might be advanced to his vacant place in the Common Pleas, and the office of attorney-general would thereby be accessible to himself. In order to bring about these changes, he had recourse to an expedient such as, according to our present notions, must appear equally at variance with discretion and with delicacy. This was no other than drawing up a tract, of which the purport may be learned from the title: "Reasons why it should be exceeding much for his Majesty's service to remove the Lord Coke from the place he now holdeth, to be chief justice of England, and the attorney to succeed him, and the solicitor the attorney." It is remarkable that this document contains an indirect eulogium on Coke's behaviour as a judge, since it admits that he had more than once opposed the views of the king; a line of conduct for which it is impossible to suppose any other motive than fearless and uncompromising integrity in the discharge of his duties. Among the reasons urged for the propriety of appointing him to the King's Bench, it is said that: "The remove of my Lord Coke to a place of less profit, though it be with his will, yet will be thought abroad a kind of discipline to him for opposing himself in the king's causes; the example whereof will contain others in more awe." And in another place it is remarked, that the proposed changes "will strengthen the king's causes

greatly amongst the judges; for both my Lord Coke will think himself near a privy counsellor's place, and thereupon turn obsequious; and the attorney-general, a new man, and a grave person, in a judge's place, will come in well to the other, and hold him hard to it, not without emulation between them, who shall please the king best." It is to be supposed that these reasons had their weight with James I, since we find Coke actually appointed chief justice of the King's Bench, (October 25th, 1613,) and the other suggestions of Bacon also complied with, by the promotion of Sir Henry Hobart and himself, Sir Henry Yelverton being preferred to the vacant solicitorship. Shortly afterwards, Sir Edward was sworn a member of the privy council.

However, this change of place had not the effect which Bacon affected to anticipate, of rendering the new chief justice of the King's Bench more pliant and obsequious. He never suffered his complaisance for the king to betray him into a step that was inconsistent with the duty or might detract from the dignity of his judicial office. On one particular occasion, a prosecution for treason being in contemplation against a minister named Peacham, who had written certain libellous passages in one of his sermons, the king wished to have the private opinions of all the judges on the case, before it was officially brought under their notice. Bacon was employed to sound them on the subject, and he encountered little or no opposition from any of them except the lord chief justice. It was Coke's favourite maxim, that he was a judge in a court and not in a chamber; and on this principle he refused to comply with the wish of his majesty; maintaining that such a mode of taking private opinions was contrary to the custom of the realm. The letters which Bacon wrote to the king on this occasion contain some curious information, as to the dexterity he employed to gain his master's ends; but it was without effect. He at length succeeded in persuading Coke to look over the papers connected with the prosecution, and afterwards, by dint of importunity, extorted from him an answer to the questions he had put; but it was so unsatisfactory, that he declared to the king he was glad for his own exculpation to be able to send it in the chief justice's own hand-writing. This and other spirited demonstrations of manly integrity are the more likely to attract our admiration, when contrasted with the many specimens of servility displayed by other distinguished characters during the same reign. The difference plainly shows, that Coke was rising superior to the willing obsequiousness which was the vice of his time; a vice that has left something of its stain on the history of his own early career, whatever the general independence of his conduct in his maturer years may have done towards obliterating it. It is to be recollected, that at this period he had perhaps stronger inducements than most of his contemporaries to court the favour of his sovereign. The continuance of his office was dependent solely on the king's will; and, as the chancellorship might be expected shortly to be vacant, there was on one hand a prospect of further preferment as a reward for obedience, on the other, the risk of disgrace as a punishment for refractory behaviour. To the honour of Coke, however, he disregarded every consideration but that of duty. One instance, indeed, is recorded of his having judicially promulgated an opinion in favour of those unjust and arbitrary expedients for raising supplies which went by the very inappropriate name of benevolences; and it is to be supposed that his conduct in this particular, whatever might be the real motive of it, was in effect excellently calculated to propitiate the good graces of James; but there are several other circumstances which go to prove that his general behaviour on the bench was any thing but that of a courtly sycophant. He never descended in this respect so low as Bacon, whose subserviency to the will of the king was indeed unbounded; and it is singular that the arts which this intriguing courtier was constantly and successfully employing to injure Coke in the king's estimation, were such as cannot but have a directly contrary effect with regard to the estimation of disinterested judges. This has been already exemplified by the arguments which he used to procure the removal of his enemy from the Common Pleas to the King's Bench; and a letter which he wrote to King James (in 1615) in order to dissuade him from appointing Sir Edward to succeed Lord Ellesmere on the woolsack, affords another instance of the same kind. In this letter, after enume-

rating several reasons, which do great credit to the person whose advancement they were intended to prevent, he concludes: "Lastly, popular men are no sure mounters for your majesty's saddle."

Two of the most remarkable instances of Sir Edward Coke's having acted a part that rendered him highly obnoxious to the king, are the dispute concerning the power of the Chancery and the celebrated case of the *commendams*; both memorable events in the history of the English jurisprudence. The particulars of both were briefly as follows.

The court of Chancery had long exercised a jurisdiction, which though now conceded to it, had been the subject of frequent complaint, and formed one of the articles against Wolsey, of revising and correcting judgments which had been obtained in the courts of common law. It was not till the reign of James that this privilege had been seriously called in question; the judges of the King's Bench, and particularly Sir Edward Coke, who were extremely tenacious of the authority of their court, then gave it as their opinion that the Chancery had no such right, and that an appeal from a judgment at law could not legally be made, except to parliament. Their doctrine was founded on the words of one of the statutes, which were framed during the reign of Edward III, for the purpose of preventing appeals to the courts of Rome. This statute, without distinctly specifying the papal courts, included them in a general enactment, which provided that whosoever should, after the delivery of a judgment in the king's courts, impeach its authority in any other court, (*en autrui court*,) should incur the penalties of a *præmunire*. According to this express declaration of the act of parliament, the jurisdiction exercised by the court of Chancery over matters which had been already adjudged in the courts of King's Bench and Common Pleas was held to be entirely illegal; and in pursuance of this doctrine Judge Croke, in his charge to the grand jurors of Middlesex, directed them to present any persons who might have called the judgments of those courts in question. Two recent cases, in which appeal had been made to the chancellor, were selected for an example; and it was determined that all the parties who had been privy to the proceedings, including solicitors, suitors, officers of the court, and even a master in Chancery, should be indicted on the statute of Edward III. However, as in consequence of some fraudulent means employed by the parties to the original suit at law, those two cases happened to have been very erroneously and unjustly decided by the King's Bench, they only served to exemplify the expediency of the interference of the court of Chancery; and the grand jurors resolutely persisted in refusing to bring in the bills required of them.

This unusual affair excited a very considerable degree of interest; and a sovereign so tenacious of his prerogative as James, was not likely to let it proceed further without his interference. As Lord Ellesmere was at the time unequal to the task of defending the cause of his court, being afflicted with an illness which was hourly expected to prove fatal, the whole proceedings were reviewed by commissioners whom his majesty appointed for the purpose. According to the memorial which was drawn up, or at least corrected, by Bacon, it appears that the investigation was conducted with great deliberation and impartiality. Care was first taken to examine whether the chancellor had been in fault; that is, whether his course of proceeding in the two cases which had formed the subject of dispute, had not been conformable to acknowledged authority and precedent. The report of the commissioners certified, "that the precedents of that kind were many and precise in the point, and constant, and in good times, and allowed many times by the judges themselves." The question was then put, "Whether, upon apparent matter of equity, which the judges of the law by their place and oath cannot meddle with or relieve, if a judgment be once passed at common law, the subject shall perish, or that the Chancery shall relieve him? and whether there be any statute of *præmunire*, or other, to restrain this power in the chancellor?" Upon mature consultation and advice the answer was, that "the Chancery was not restrained by any statute in that case." The clerks of the King's Bench were next desired to search for precedents of indictments against the Chancery; and on their declaring that they were able to find only two, and those merely of indictments offered or found, on which there had been no further proceeding, his majesty (in the words of the memorial) "thought then it was time to question the misdemeanor and

contempt in scandalizing and dishonouring his justice in that high court of Chancery in so odious a manner." Proceedings were therefore instituted in the star-chamber against the offenders, and the conduct of the judges of the King's Bench was referred to the consideration of the council table.

It is generally admitted that the course pursued by Sir Edward Coke and his associates on this occasion was highly discreditable to them. The whole dispute, as Blackstone justly remarks, did not tend much to the advancement of justice; and it is certain that the violent measures adopted for the sake of asserting the independence of the King's Bench, were wholly inconsistent with the moderation and decorum which ought ever to characterise the measures sanctioned by courts of justice. However, the proceeding at least shows that Coke was not the servile minister of the king's will; and his conduct in the case of the *commendams*, for which he was arraigned at the council table at the same time as for the other offence, will be allowed to merit unqualified admiration.

The practice of giving livings in *commendam* was usually adopted by the crown for the sake of adding to the profits of poor bishoprics, or in some instances of poor benefices. It could only be resorted to in the case of livings to which the right of presentation had, either by lapse or otherwise, devolved upon the king; when the sovereign might *recommend* a clerk as a fit person to discharge the duties till such time as a new incumbent could be regularly appointed. Now it happened that on the occasion of a writ of *quare impedit** brought against the Bishop of Litchfield and Coventry, the defendant pleaded that he held the living in dispute in *commendam*; and, among other important points of law which were involved in the discussion of the case, the right of the sovereign to grant *commendams* was called in question. The king, who perhaps anticipated what would happen, had ordered secretary Winwood, and the Bishop of Winchester, Dr. Bilson, to attend in court during the trial, and make a report to him of the proceedings. The bishop alone, however, was present at the hearing of the cause, and he gave his majesty to understand that Serjeant Chiborne, who argued against the *commendams*, had maintained several positions prejudicial to the royal prerogative; among others, that the king had only power to grant *commendams* in case of necessity, which necessity could never, in fact, exist, since no clerk was bound to keep hospitality above his means. On the receipt of this information, the attorney-general, Bacon, was immediately directed to acquaint Sir Edward Coke that it was the king's pleasure all further proceedings in the cause should be stayed till the judges could have an opportunity of conferring with his majesty on the subject. At Coke's desire a similar intimation was officially sent to all the other judges, and they assembled together for the purpose of consulting as to the course they should pursue. The result of their deliberation was a resolution to act in every respect as though they had received no notice to suspend the proceedings: and a letter was despatched to James, who was then absent from London, containing a firm but respectful remonstrance against the command that had been addressed to them, together with their reasons for not obeying it. The letter, which is signed by all the twelve judges, bears such honourable testimony to their integrity and independence; and the answer of James is so characteristic of the notions entertained by that weak monarch on the subject of his prerogative, that both deserve to be quoted at length.

"Most dread, and most gracious Sovereign,

"It may please your most excellent majesty to be advertised that this letter here inclosed was delivered unto me your chief justice, on Thursday last in the afternoon, by a servant of your majesty's attorney-general; and letters of the like effect were on the day following sent from him by his servant to us your majesty's justices of every of the courts at Westminster. We are, and ever will be ready with all faithful and true heart, according to our bounden duties, to serve and obey your majesty, and think ourselves most happy to spend our times and abilities to do your majesty true and faithful service in this present case mentioned in this letter. What information hath been made unto you, whereupon Mr. Attorney doth ground

* *Quare impedit*; literally, *wherefore he prevents*. These two words give the name to the writ in which they occur. It is granted against any one who, by wrongfully procuring a clerk to be instituted in a vacant benefice, *prevents* the real proprietor of the advowson from exercising his right of presentation.

his letter, from the report of the Bishop of Winton, we know not; this we know, that the true substance of the cause summarily is this: it consisteth principally upon the construction of two acts of parliament, the one of the twenty-fifth year of King Edward III, and the other of the twenty-fifth year of King Henry VIII, whereof your majesty's judges, upon their oaths, and according to their best knowledge and learning, are bound to deliver their true understanding faithfully and uprightly; and the case between two for private interest and inheritance earnestly called for justice and expedition. We hold it our duty to inform your majesty, that our oath is in these express words: that in case any letters come unto us contrary to law, that we do nothing by such letters but certify your majesty thereof, and go forth to do the law, notwithstanding the same letters. We have advisedly considered of the said letter of Mr. Attorney, and with one consent do hold the same to be contrary to law, and such as we could not yield to the same by our oath; assuredly persuading ourselves that your majesty being truly informed that it standeth not with your royal and just pleasure to give way to them, and knowing your majesty's zeal to justice to be most renowned, therefore we have, according to our oaths and duties, at the very day prefixed the last term, proceeded, and thereof certified your majesty, and shall ever pray to the Almighty for your majesty in all honour, health, and happiness, to reign over us."

Serjeant's Inn, 25th April, 1616.

"James Rex,

"Trusty and well-beloved counsellors, and trusty and well-beloved, we greet you well. We perceive, by your letter, that you conceive the commandment given you by our attorney-general in our name to have proceeded upon wrong information: but if you list to remember what princely care we have ever had, since our coming to this crown, to see justice duly administered to our subjects with all possible expedition, and how far we have ever been from urging the delay thereof in any sort, you may safely persuade yourselves that it was no small reason that moved us to send you that direction. You might very well have spared your labour in informing us of the nature of your oath, for although we never studied the common law of England, yet we are not ignorant of any points which belong to a king to know; we are therefore to inform you hereby, that we are far from crossing or delaying any thing which may belong to the interest of any private party in this case; but we cannot be contented to suffer the prerogative royal of our crown to be wounded through the sides of a private person: we have no care at all which of the parties shall win this process in this case, so that right prevail, and that justice be truly administered. But on the other side we have reason to foresee that nothing be done in this case which may wound our prerogative in general; and therefore so that we may be sure that nothing shall be debated amongst you which may concern our general power of giving *commendams*, we desire not the parties to have one hour's delay of justice: but that our prerogative should not be wounded in that regard for all times hereafter, upon pretext of private persons' interest, we sent you that direction, which we account as well to be wounded if it be publicly disputed upon, as if any sentence were given against it: we are therefore to admonish you that, since the prerogative of our crown hath been more boldly dealt withal in Westminster Hall, during the time of our reign, than ever it was before in the reigns of divers princes immediately preceding us, that we will no longer endure that popular and unlawful liberty; and therefore we were justly moved to send you that direction to forbear to meddle in a cause of so tender a nature till we had further thought upon it. We have cause indeed to rejoice at your zeal for your speedy execution of justice; but we would be glad that all our subjects might so find the fruits thereof as that no pleas before you were of older date than this is. But as to your argument, which you found upon your oath, you give our predecessors, who first founded the oath, a very charitable meaning, in perverting their intention and zeal to justice, to make a weapon of it to use against their successors; for although your oath be, that you shall not delay justice between any private persons or parties, yet it was not meant that the king should thereby receive harm before he be forewarned thereof; neither can you deny but that every term you will, out of your own discretions, for reasons known unto you, put off either the hearing or determining of any ordinary cause betwixt private per-

ons till the next term following. Our pleasure therefore is, who are the head and fountain of justice under God in our dominions, and we out of our absolute power and authority royal do command you, that you forbear to meddle any further in this plea till our coming to town, and that out of our own mouth you hear our pleasure in this business, which we do out of the care we have, that our prerogative may not receive an unwitting and indirect blow, and not to hinder justice to be administered to any private parties, which no importunities shall persuade us to move you in. Like as only for the avoiding of the unreasonable importunity of suitors in their own particular, that oath was by our predecessors ordained to be ministered unto you. So we wish you heartily well to fare.

"*Postcript.*—You shall, upon the receipt of this letter, call our attorney-general unto you, who will inform you of the particular points which we are unwilling to be disputed of in this case."

Shortly after this correspondence the king returned to London, and the twelve judges were immediately summoned before the council at Whitehall (June 6th, 1616) to answer for their conduct. His majesty himself recapitulated the principal circumstances that had occurred, and commented with much asperity on the liberties that had been taken with his prerogative. With the formal pedantry for which he was conspicuous, he divided the charges against them into faults of matter and manner, and those of matter he distinguished into faults of omission and of commission. The omission consisted in not interrupting and reproving the barrister who had presumed to argue against his prerogative. "He had observed," he said, "that ever since his coming to the crown the popular sort of lawyers had been the men that most affrontedly in all parliament had trodden upon his prerogative, which being most contrary to their vocation of any men, since the law or lawyers can never be respected if the king be not reverenced; it did therefore best become the judges of any, to check and bridle such impudent lawyers, and in their several benches to disgrace them that bear so little respect to their king's authority." The faults of commission chiefly regarded the letter, to which he took exceptions both in matter and form; in matter, because he affirmed that the delay which had been required was neither unnecessary nor unjust, that it was merely sufficient for maturity of advice; and that there could not be a more urgent cause for staying the proceedings, than the consulting with the king in a case which so nearly concerned the crown. "As for the form of the letter, his majesty noted that it was a new thing, and very indecent and unfit for subjects to disobey the king's commandment, but most of all to proceed in the mean time and to return to him a bare certificate; whereas they ought to have concluded with the laying down and representing of their reasons modestly to his majesty why they should proceed, and so to have submitted the same to his princely judgment, expecting to hear from him whether they had given him satisfaction."

The report of the proceedings in council, from which the above statement is extracted, goes on to say, that immediately after this declaration of the king the twelve judges fell on their knees and acknowledged their error as to the form of the letter, for which they craved his majesty's gracious favour and pardon; but that Sir Edward Coke entered into a defence of the matter of it, showing that the delay required would have been a delay of justice, and therefore contrary to law and the judge's oath. After some little altercation between the attorney-general and the lord chief justice, this point was referred to the decision of Lord Ellesmere, who gave it as his opinion that the stay which had been required by his majesty was not against the law nor the judge's oath. The judges were then severally asked, "Whether if at any time, in a case depending before them, his majesty conceived it to concern him either in power or profit, and thereupon required to consult with them, and that they should stay proceedings in the mean time, they ought not to stay accordingly?" and they all, with the exception of the lord chief justice, declared that they would. But Sir Edward Coke contented himself with answering that "when the case should be he would do that which should be fit for a judge to do." They were afterwards dismissed; his majesty commanding them "to keep the bounds and limits of their several courts, not to suffer his prerogative to be wounded by rash and unadvised pleading before them, or by new invention of law; for as he well knew the true and ancient common law is the

most favourable for kings of any law in the world, so he advised them to apply their studies to that ancient and best law, and not to extend the power of any other of their courts beyond their due limits, following the precedents of their best ancient judges, in the times of the best government; and that then they might assure themselves that he, for his part, in his protection of them, and expediting of justice, would walk in the steps of ancient and best kings." They were then permitted to proceed in the cause, which was finally decided against the Bishop of Litchfield and Coventry.

It is not to be supposed that this unjustifiable attempt to corrupt the fountain of public justice could have been made without exciting among a large portion of the community a strong feeling of disgust and disaffection towards the government under which it had originated. But we should greatly exaggerate the effect which this transaction must have had on the minds of the people at large, were we to estimate it according to what we might conceive would be the probable consequences of a similar occurrence in our own times. The press did not distribute periodically to the remotest corners of the kingdom a knowledge of those affairs in which every member of the state is concerned; nor was this attack on the liberties of the people of a nature such as necessarily to attain (like the case of the ship money, for example) immediate publicity. But this adds to the merit of Coke. He could not have been excited to act thus by the mere wish of courting popularity. Unfortunately, too, had he been inclined to search for precedents of corruption among his predecessors on the bench, by way of authorizing his compliance with the king's wishes, he would have found many instances well suited to his purpose. Indeed, obedience to the will of the sovereign was considered, in some sort, the duty of the judges, at a time when they held their offices by no safer tenure than the meanest servant of his household. Sir Edward Coke was perhaps the first who set the example of strict independence on the bench. After the Stuarts were finally driven from the throne, and a rational system of civil liberty had been established, it was wisely considered, that the surest method of ensuring for the future the just and impartial administration of the laws, would be to maintain, in their utmost purity, the independence, the integrity, and the dignity of the judges. Accordingly, during the reign of William III., it was enacted, that only the address of both houses of parliament should be capable of procuring their removal from the bench. Unfortunately for James, and still more so for his successor, they could never understand (what it now needs no argument to prove) that the honour of the crown and the liberty of the subject can mutually support each other.

The firm and resolute conduct of the lord chief justice had given great umbrage to the king. It is supposed that this weak monarch, in addition to his other reasons for being displeased with Coke, had a mean jealousy of the popularity he had acquired. It was evident, indeed, that the fearless integrity which had thwarted his majesty's views was the principal cause of that popularity; and the circumstance did not escape the attention of James, who afterwards remarked that Sir Edward Coke had obtained it without "having in his nature one part of those things which are popular in men, being neither civil, nor affable, nor magnificent." He had, however, taken the surest means to acquire the lasting and deserved esteem of his countrymen. This was not the only occasion on which he had protected the rights of the nation against the arbitrary and unconstitutional encroachments of that prerogative, the undue exercise of which alienated from James the affections of his people, and brought his successor to the scaffold. He had more than once countenanced appeals to the King's Bench from the judgments of the commissioners of sewers, for whom, it is well known, extraordinary and illegal powers had been created. The privy council subsequently claimed the sole right of hearing complaints against these commissioners, and several persons who had brought actions against them at common law were committed to prison; but these violent measures, though not openly resisted, were sufficiently censured by the public opinion to recall the memory of the obligations due to him who had upheld the rights of the people. However, those actions which were calculated to excite the esteem or the admiration of the friends of civil liberty, were exactly those which were most likely to injure the author of them in the favour of James; and the conduct of Coke,

with regard to the commissioners of sewers, had been such as particularly to draw down on him the enmity of the council.

Nor were these the only clouds that were lowering over him. In the preceding year, in his capacity of lord chief justice, he had been actively and zealously engaged in the investigation of the circumstances connected with the atrocious murder of Sir Thomas Overbury. In the course of the inquiry which took place relative to this assassination it was proved that it had been perpetrated by the favourite, Somerset, and Lady Essex, between whom Overbury had discovered, and endeavoured to prevent, an illicit intercourse. The circumstances of the case were peculiarly revolting. The victim of their resentment had been, under some slight pretext, conveyed a prisoner to the Tower; and the lieutenant-governor was induced to become a party to the plot that was laid for his destruction. After several ineffectual attempts, he was at length killed by a violent poison. The crime remained some years unpunished, but at length a strict inquiry was set on foot. It was found that several subordinate agents had been participators in it, and these suffered the death they had justly deserved. Somerset and Lady Essex escaped with their lives; but the downfal of the favourite was the consequence of the discovery; and Coke, who had been indefatigable in his endeavours to detect the perpetrators of the crime, was consequently in no small degree instrumental in procuring his disgrace. It is needless to add that this made him many and very powerful enemies; and it is not to be supposed but that they availed themselves of the opportunity which now presented itself for poisoning the ear of the king against him. Indeed, James himself is supposed to have harboured a deep feeling of resentment against the lord chief justice, on account of certain mysterious hints which are said to have escaped him during the trial of Somerset and his accomplices. It is certain that whispers concerning some secret transaction in which the king was implicated, had been circulated about the court soon after the institution of legal proceedings against the murderers of Sir Thomas Overbury; and many have not scrupled to believe (though without much foundation for the story) that they related to the poisoning of the hope of the nation, the young prince Henry; a crime very generally attributed at the time to Viscountess Rochester, though James (however unjustly) has not entirely escaped the suspicion of being privy to the death of his own son. It was natural that the persons who credited and gave countenance to such rumours should be personally odious to the king, nor is it improbable that such a motive should have weighed with him even stronger than political reasons, when he determined on removing Coke from his post. Sir George Villiers also, who afterwards became Duke of Buckingham, having been thwarted by the chief justice in his endeavours to procure the reversion of a lucrative situation in the court of King's Bench, did not neglect an occasion so favourable for the exercise of his resentment, which his influence with James rendered sufficiently formidable. All these circumstances combined to produce Sir Edward Coke's disgrace; but the avowed cause of it was his conduct in the case of the *commendams*. For this he was arraigned in the privy-council. The accusation against him was reduced to three heads: 1. an act done; 2. speeches of high contempt uttered in the seat of justice; 3. uncomely and undutiful carriage in the presence of his majesty, the privy-council, and judges. These charges having been officially notified to him, on the 30th of June, 1616, he was again summoned before the council, where, on his knees, he received intimation of the sentence which the king had passed on him. The substance of it was, that he should be sequestered from the council-table till his majesty's pleasure was further known; that he should forbear from riding his summer circuit as justice of assize; and that, during the vacation, he should employ his leisure in revising and correcting his Reports, in which the pedantic despot, James, declared that Coke had uttered for law many dangerous conceits of his own, to the prejudice of his crown, parliament, and subjects. It will scarcely be credited, that one of the charges brought against the lord chief justice was, that his coachman used to ride bareheaded before him; a mark of dignity which it was said he was by no means entitled to assume, and of which the earl marshal must take notice. To this Sir Edward Coke (very innocently no doubt) replied, that

his coachman did so for his own convenience, and not in consequence of any orders having been given him to that effect. A few months afterwards (Nov. 15th) he was altogether removed from the chief justiceship, and his place was supplied by Sir Henry Montague, the recorder of London. It is worthy of observation, that the new judge was not appointed until he had entered into a written engagement with Buckingham, by which he agreed to put the trustees of the favourite in possession of the situation he had been deprived of through the influence of Sir Edward Coke. This fact sufficiently shows what was the principal cause of Coke's removal from the bench. It may also in some measure explain why he was first suspended, and afterwards entirely removed; the intermediate time being no doubt left him to propitiate the good grace of Buckingham by submission to his wishes. If this be the case, it must reflect eternal honour on Coke, that he preferred renouncing his office altogether to procuring his continuance in it by unworthy means. This is one of a thousand instances in which proud integrity has fallen a sacrifice to the machinations of interested cabal and court intrigue.

Coke, however, did not remain long in disgrace. Some time before his removal from the bench, a negotiation had been set on foot concerning the marriage of his youngest daughter with Sir John Villiers, the brother of the Earl of Buckingham. He had then refused his consent to the match; but it is to be supposed, that the growing influence of the favourite, and the change that had been wrought in his own fortune, afterwards made him sensible of the advantages to be derived from so powerful an alliance, so that he was not indisposed to listen to a renewal of the same overtures, when a change in the relative situation of both parties had rendered an union between them more desirable. As to the sentiments the young lady herself might entertain on the subject, they appear not to have been thought worthy of the slightest consideration. Coke had himself consulted his interest alone in his own marriage with Lady Hatton, from whom he had long lived almost wholly estranged; and he was not of a character to sacrifice his own advancement to the inclination of his daughter. It was through the medium of Secretary Winwood that the match was at length effected. That minister had felt himself offended by a certain tone of superiority which Bacon, on being promoted to the office of lord keeper, had thought proper to assume towards him; and it thenceforward became his study to raise up Coke from the disgrace into which he had fallen. With this view he obtained permission to renew the negotiation which had before been broken off, relative to the alliance with the family of the favourite. Buckingham, tempted by the offer of a large marriage portion which Coke promised with his daughter, immediately consented to the match; but it was not effected without considerable difficulty. Lady Hatton, who was always at variance with her husband, had a dislike to a connexion with the family of the Villiers, and was probably offended that she had not been in the first instance made privy to the negotiation. As she was a woman of masculine spirit, she determined to oppose the match; and accordingly, after pretending in vain to allege a contract with Lord Oxford, as a reason why the marriage could not take place, she caused her daughter to be secretly conveyed to the house of Sir Edmund Withipole, near Oatlands, whence she was afterwards removed to a residence of the Lord of Argyle's, in the neighbourhood of Hampton Court. Sir Edward, on finding his daughter had been sent from home, applied for a warrant to reclaim her; but in the mean time becoming acquainted with the place of her concealment, he determined on instantly rescuing her by force. Accompanied, accordingly, by his son and by about a dozen well armed men he proceeded to Hampton Court, tore down the doors of the house where she was confined, and carried her away. Lady Hatton having no other means of redress, appealed to the privy council; and thus this domestic quarrel became at length an affair of state.

The lord keeper, Bacon, used every exertion to prevent the match, which he was aware would be the means of reestablishing Coke in the king's favour. It is supposed to have been at his instigation that proceedings were instituted in the Star-Chamber against the perpetrator of this outrage, as the forcible rescue was affectedly called; though he could not but know that it was an act per-

fectly justifiable by law. This was not the only step he took towards breaking off the intended marriage. The following letter was addressed by him to the Earl of Buckingham:—

My very good Lord,
I shall write to your lordship of a business which your lordship may think to concern myself; but I do think it concerneth your lordship much more. For as for me, as my judgment is not so weak to think it can do me any hurt, so my love to you is so strong, as I would prefer the good of you and yours before mine own particular. It seemeth Secretary Winwood hath officiously busied himself to make a match between your brother and Sir Edward Coke; and as we hear, he doth it rather to make a faction than out of any great affection to your lordship. It is true he hath the consent of Sir Edward Coke, (as we hear,) upon reasonable conditions for your brother, and yet not better than without question may be found in some other matches. But your mother's consent is not had, nor the young gentlewoman's, who expecteth a great fortune from her mother, which without her consent is endangered. This match, out of my faith and freedom to your lordship, I hold very inconvenient both for your brother and yourself.

First, he shall marry into a disgraced house, which in reason of state is never held good.

Next, he shall marry into a troubled house of man and wife, which in religion and christian discretion is disliked.

Thirdly, your lordship will go near to lose all such your friends as are adverse to Sir Edward Coke, (myself only excepted, who out of a pure love and thankfulness shall ever be firm to you.)

And lastly and chiefly, (believe it,) it will greatly weaken and distrust your service. For though in regard of the king's great wisdom and depth I am persuaded those things will not follow, which they imagine; yet opinion will do a great deal of harm and cast the king back, and make him relapse into those inconveniences which are now well on to be recovered.

Therefore my advice is, and your lordship shall do yourself a great deal of honour, if, according to religion and the love of God, your lordship will signify unto my lady your mother that your desire is that the marriage be not pressed or proceeded in without the consent of both parents; and so either break it altogether, or defer any further delay in it till your lordship's return. And this the rather for that (besides the inconvenience of the matter itself) it hath been carried so harshly and inconsiderately by Secretary Winwood, as for doubt that the father should take away the maiden by force, your mother to get the start hath conveyed her away secretly, which is ill of all sides. Thus, hoping your lordship will not only accept well, but believe my faithful advice, who by my great experience in the world must needs see further than your lordship can, I ever rest, your lordship's true and most devoted friend and servant, FRANCIS BACON.

In another letter which he wrote to the king on the same subject, the following passage occurs:—

"Your majesty's prerogative and authority have risen some just degrees above the horizon more than heretofore; which hath dispersed vapours: your judges are in good temper, your justices of peace (which is the great body of the gentlemen of England) grow to be loving and obsequious, and to be weary of the humour of ruffling: all mutinous spirits grow to be a little poor, and to draw in their horns; and not the less for your majesty's disauctorizing the man I speak of. Now then I reasonably doubt that if there be but an opinion of his coming in with the strength of such an alliance, it will give a turn and relapse in men's minds into the former state of things, hardly to be holpen, to the great weakening of your majesty's service."

Again: "he is by nature unsociable, and by habit popular, and too old to take a new plye. And men begin already to collect, yea, and to conclude that he that raiseth such a smoke to get in, will set all on fire when he is in."

The lord keeper was not content with taking such measures as these: he even ventured to threaten Winwood with a *præmunire* for having granted the warrant. But in this he went too far. Buckingham was highly incensed with his conduct, and even the king, who was on his return from Scotland, wrote him a severe letter on the subject (25th July, 1617.) "Every wrong," he said, "must be judged by the first violent and wrongous ground, whereupon it proceeds. And was not the thefteous stealing away of the

daughter from her own father the first ground whereupon all this great noise hath since proceeded? For the ground of her getting again came upon a lawful and ordinary warrant, subscribed by one of our council, for redress of the former violence; and except the father of a child might be proved to be either lunatic or idiot, we never read in any law that either it could be lawful for any creature to steal his child from him, or that it was a matter of noise and streperous carriage for him to hunt for the recovery of his child again. Whereas you talk of the riot and violence committed by him, we wonder you make no mention of the riot and violence of them that stole away his daughter, which was the first ground of all that noise, as we said before. For a man may be compelled by manifest wrong beyond his patience; and the first breach of that quietness, which hath ever been kept since the beginning of our journey, was made by them that committed the theft. And for your laying the burden of your opposition upon the council, we meddle not with that question; but the opposition, which we justly find fault with you, was the refusal to sign a warrant for the father to the recovery of his child, clad with those circumstances, as is reported, of your slight carriage to Buckingham's mother, when she repaired to you upon so reasonable an errand. What farther opposition you made in that business, we leave it to the due trial in the own time. But whereas you would distinguish of times, pretending ignorance either of our meaning or his, when you made your opposition; that would have served for a reasonable excuse not to have furthered such a business till you had been first employed in it; but that can serve for no excuse of crossing any thing that so nearly concerned one, whom you profess such friendship unto. We will not speak of obligation; for surely we think, even in good manners, you had reason not to have crossed any thing, wherein you had heard his name used, till you had heard from him. For if you had willingly given your consent and hand to the recovery of the young gentlewoman; and then written both to us and to him what inconvenience appeared to you to be in such a match; that had been the part indeed of a true servant to us, and a true friend to him. But first to make an opposition, and then to give advice by way of friendship, is to make the plough go before the horse." It appears that at this time, or at least very shortly after it, Coke was reinstated (probably by the mediation of the favourite) in the good graces of his majesty, whose party he joined as it returned from Scotland. On the 3d of September, Sir Henry Yelverton, who was also among the king's followers, wrote to the lord keeper from Daventry, warning him of the danger he had incurred by his opposition to Buckingham. In the same letter he remarks: "Sir Edward Coke, as if he were already upon his wings, triumphs exceedingly; hath much private conference with his majesty; and in public doth offer himself, and thrust upon the king, with as great boldness of speech as heretofore. It is thought, and much feared, that at Woodstock he will again be recalled to the council table; for neither are the earl's ears, nor his thoughts, ever off him." This report was not without foundation; for on the very day of the king's arrival in London (15th September, 1617) the late lord chief justice was restored to his place in the privy council. Whatever obstacles still remained in the way of the marriage were now finally removed. Proceedings had been instituted in the star-chamber, at the suit of Lady Hatton, against her husband; but they had been arrested by the king's order; and she was for some time placed in confinement. At length Lady Compton, the Earl of Buckingham's mother, prevailed on her to discontinue the action, and finally to give her consent to the match, which was accordingly concluded with great pomp.

Sir Edward Coke, however, still remained at variance with his wife. Their quarrels were not merely the effect of occasional ebullitions of temper, such as may disturb the domestic comforts of a family for awhile, without causing any permanent disunion among the members of it. Lady Hatton was a woman of a haughty and imperious character, who was constantly on the watch for opportunities to remind her husband how much he was indebted to her for the honour and the wealth he had derived from her alliance. On the other hand, the deportment of Sir Edward Coke had nothing conciliatory in it; and, indeed, if we are to form

our opinion of his temper from the ebullitions of it which he could not control even in public, it was very far from being of a nature to render him, under any circumstances, an amiable husband or father of a family. Domestic happiness they never enjoyed together. They had separate houses and separate establishments; Sir Edward occasionally occupying his chambers in the Temple, while his lady fixed her residence at Hatton House, in Holborn; or retiring to his seat at Stoke Pogies, in Buckinghamshire, (the same which is now the residence of the descendant and representative of the celebrated William Penn,) when she either remained in London, or tenanted her mansion of Corfe Castle. Among other subjects of angry contention between them, these different dwellings and their appurtenances formed a fertile theme for dispute. At one time we find Sir Edward publicly accusing his wife of having purloined his plate, and substituted counterfeit *alkumy* in its place, with intent to defraud him. On another occasion, Lady Hatton complains of his seizing her coach, coach-horses, and wearing apparel, maltreating her servants, and causing her to suffer "beyond the measure of any wife, mother, or even any ordinary woman in the kingdom." It might be supposed that when she had been persuaded to give her consent to her daughter's union with Villiers, some show at least of reconciliation with her husband would have taken place; but this was not the case; and the very day on which she gave a magnificent entertainment in honour of the marriage, Sir Edward, uninvited and unnoticed by his wife, dined in the Temple. There exists abundant testimony that their mutual resentment, and it may almost be said hatred, against each other, was cherished for some time after this period. At the end of four years (1621) they were in some degree reconciled by the personal interference of the king, who undertook to be the mediator between them; but they always remained strangers to domestic happiness. As for their daughter, who had from the beginning expressed a strong dislike to Sir John Villiers, her marriage, as might have been expected, was an unhappy one.

So soon as a probability had appeared of Sir Edward's being reinstated in the king's favour, the wary courtier, Bacon, had dropped all appearance of resentment against him; and had even taken the trouble to explain away some parts of his conduct towards him. He was also particularly careful to repair the fault he had committed with regard to Buckingham, by assiduous endeavours to propitiate the good graces of the favourite. A short extract from a letter which he wrote to King James, with the view of deprecating the anger of that monarch occasioned by his opposition to the marriage of Coke's daughter, will sufficiently illustrate these facts. "It is true," he says, "that in those matters which, by your majesty's commandment and reference, came before the table concerning Sir Edward Coke, I was sometimes sharp, it may be too much; but it was with the end to have your majesty's will performed; or else when methought he was more peremptory than became him, in respect of the honour of the table. It is true also, that I disliked the riot or violence, whereof we of our council gave your majesty advertisement by our joint letter: and I disliked it the more, because he justified it to be law; which was his old song. But in that act of council, which was made thereupon, I did not see but all my lords were as forward as myself," &c. And again, alluding to an intimation given him by the Earl of Buckingham, for whom he had just professed his readiness to spend his life, he adds: "After I had received, by a former letter of his lordship, knowledge of his mind, I think Sir Edward Coke himself, the last time he was before the lords, might particularly perceive an alteration in my carriage. And now that your majesty hath been pleased to open yourself to me, I shall be willing to further the match by any thing, that shall be desired of me, or that is in my power." In consequence of this disposition, a reconciliation appears to have taken place between the lord keeper and Coke; and accordingly we find no traces of animosity in the conduct of the latter, when, at a subsequent period, (1621,) he was called upon to take a share in the proceedings which terminated in the disgrace of Bacon.

Sir Edward Coke was a member of the parliament which necessity rather than inclination forced the king to summon in 1621; and the same upright and independent spirit, which had done him so much honour in the affair of the

*commendams*, again manifested itself in his deportment while he retained his seat in the commons. But here he stood not alone. The representatives of the people, who in former reigns had been without power or influence in the political world, had at length become sensible of their own importance, and had already begun to assert the dignity and independence of their body. Previous to the reign of James I. their assent had indeed been necessary for the enactment of statutes, and the granting of supplies, but they had seldom or never attempted to take cognizance of any concerns of the state that were not immediately connected with these privileges. As to freedom of debate, it was altogether unknown in the assembly. Some faint attempts had been made during the reign of Elizabeth to uphold such a right; but they had been peremptorily checked by the queen; and the great popularity of her government, at a time when she held the parliament in the most strict submission to her will, is a convincing proof that the importance of this body was very far from being adequately appreciated in her time. When the commons ventured to recommend that she would provide for the succession; when they proposed new regulations for the amelioration of the church establishment, or urged the reformation of some flagrant abuses of prerogative, it does not appear to have excited either surprise or indignation that they should be severely reprimanded for their presumption, and be desired not to meddle for the future with what was above their capacity. Even while Sir Edward Coke had been speaker of the house, in 1592, the queen had expressly prohibited the members from arguing on matters of state, and had given them to understand that their freedom of speech extended no farther than the mere utterance of ay or no, without comment or observation. This intimation was not meant as an idle threat. The independent and spirited Peter Wentworth was sent to the Tower for venturing to disregard it; and three other members who had abetted him were also thrown into prison by the queen's order. Their release was not effected by the interposition of the house. Certain privy councillors recommended that the idea of a petition for that purpose should be given up, lest it might only serve to irritate her majesty still further; and this advice, instead of calling forth the indignation of those to whom it was addressed, was not only received with thankfulness and humility, but was moreover acted upon. The idea of steadfastly resisting the arbitrary imprisonment of one of their body, as a breach of their most important privilege, seems never to have been entertained, much less expressed, by the intimidated commons of that period. Indeed their notions in general, whether real or affected, concerning the extent of the royal prerogative, were entirely at variance with just ideas of the liberty of the subject, and consequently of the independence of their own body. To be convinced of this it is sufficient to look over the speeches that were made in the 43d of Elizabeth's reign, particularly when the subject of monopolies was brought under the consideration of parliament; discourses, as Hume has well remarked, more worthy of a Turkish divan than of an English house of commons.

However, the leaven of spirit and of independence which did exist, though it must be allowed in a very small degree, in the parliaments of Elizabeth spread rapidly through the assembly. A difference might be remarked in the temper of the house of commons even towards the latter part of her reign. In the 23d of Elizabeth, they suffered the chancellor to issue new writs for the places of members whom, under any pretext, he might judge incapable of attending their duties; but at a later period this dangerous practice did not escape their censure; and though they were as usual reprimanded by the queen for presuming to meddle in matters which, according to her, were not in their province, they had spirit enough to propose a motion, declaring that the discussion of such cases belonged solely to the house. This privilege of deciding all questions relative to the customs and the constitution of their body, they strenuously asserted in the 2d of James I. insomuch that the king, who at the beginning of the discussion had talked loudly of his absolute power, and the authority of his royal prerogative, found it expedient to propose a compromise of the difference that had arisen between himself and the commons. Even Elizabeth, though she had on all occasions maintained her dignity unimpaired, had more than once found it expedient to make concessions, rather than come to an open rupture with her parliament. At the same time that her messages to the house were conceived in terms of the most haughty

and indignant displeasure, it sometimes did not require much penetration to see that a certain degree of fear lurked behind this show of firmness. With James this was much more apparent. We find him, after the example of his predecessor, desiring the parliament not to interfere in matters beyond their capacity; reminding them that all their privileges were derived from the special grace of himself and his ancestors; and maintaining that it was highly impertinent in them even to reason upon what he as an absolute king might do in the height of his power; but these empty speeches were often merely designed as a mask to cover the real apprehensions he could not but feel for the fate of his cherished prerogative. Whatever fears he entertained on the subject, he certainly pursued a method very ill calculated to remove the cause of them. The commons of England were no longer to be frightened into concessions; and when the necessities of the king obliged him to assemble them in 1621, they were fully prepared to resist every attack that might be made on their privileges. The result of the contest which ensued was such as might have been anticipated. The memorable proceedings which took place during the existence of this parliament, and particularly in the second session of it, are familiar to all who are conversant with the history of our constitution. The fruitless attempts of James to crush the rising spirit of liberty which animated the whole nation; the remonstrances made by the representatives of the people; and the unfounded pretensions of the king, who endeavoured to strike at the root of all their privileges, called forth that celebrated protestation of the commons, in which they declared: "that the liberties, franchises, privileges, and jurisdictions of parliament, are the ancient and undoubted birthright and inheritance of the subjects of England." In all these proceedings, Sir Edward Coke, who was one of the leading members on the popular side, took an active part; and the consequence was, that he was committed to the Tower, (27th December, 1621,) and subsequently dismissed from the privy council. He had been treated with much distinction and confidence ever since he had been reinstated to his place at the council table; and it has been doubted what motive could induce him so suddenly to become an opponent of the interests of the crown. But it should be recollected, that the change was in reality by no means a sudden one. His conduct, not only in the case of the *commendams*, but on many other occasions, had proved that he was an enemy to the arbitrary exercise of the royal perogative; and it must be allowed, that the evident intentions of infringing on the liberties of the people, which were continually displayed by the king, but more particularly about the time when the parliament was first called, were calculated to inspire every real friend of his country with a resolution to oppose them.

James was highly incensed at the audacity which Coke had shown in opposing the crown; and several expedients were tried, in order to punish indirectly what it would have been imprudent and dangerous to visit openly with a heavy infliction. On Sir Edward's committal to the Tower, his chambers were broken open, and his papers seized, probably with the hope of discovering some writings which might furnish matter for a criminal prosecution. This expectation, however, was disappointed; and two other attempts which were made to injure him, (the one by endeavouring to prove him guilty of misconduct during the trial of Somerset, the other by a prosecution for debt,) succeeded no better. Some years afterwards, (1625,) his independent spirit again excited the resentment of the court against him; and he was ordered by the king to execute a commission in Ireland; an unjustifiable pretext often resorted to at that time, for the purpose of removing obnoxious persons. However, his departure from England does not appear to have been eventually insisted upon, and his popularity was, in all probability considerably increased by the expectation of his compulsory absence.

On the accession of Charles I. to the throne, Sir Edward Coke was among the number of those who waited on him with assurances of respect and loyalty; but the new monarch refused him admission to his presence; and that he might be prevented from resuming his seat in parliament, he was afterwards appointed high sheriff for Buckinghamshire. It was to no purpose that he urged several objections against his serving the office; they were overruled by the council, and he was compelled to yield. It will be remarked, that such a situation as that of high sheriff, however honourable and distinguished it may be usually

considered, could not be filled by one who had lately occupied the station of lord chief justice, without his being subjected to a mortifying exhibition of his fallen fortunes; since his duty at the assizes required him to attend on the judges, who had so recently been his inferiors; and it is more than probable that his enemies at court had calculated on exposing him to this insult, when they forced him to accept the charge. It was not till the year 1628, that he again became a member of the House of Commons. He took his seat as knight of the shire for Bucks, being at the time in his seventy-ninth year; and, notwithstanding his advanced age, bore a leading part in the proceedings that took place during that memorable session. It was then that the commons of England, united as in one common cause, first made a resolute and successful resistance against those encroachments of the royal perogative, which, if ratified by the acquiescence of the nation, would have reduced the freedom of our constitution to a mere shadow. The grievances that called loudly for redress were heavy and numerous. Those which most particularly excited the indignation of parliament were the extortions of various kinds, by which the security of the subject's property had been invaded, and the despotic violation of his personal liberty by arbitrary and illegal imprisonment. The unconstitutional means which had been employed for the raising of subsidies, such as the billeting of soldiers, and the exaction of loans by benevolence and privy seal, were the first of these topics that came under discussion; and Sir Edward Coke was one of the members who took the greatest share in the debate to which it gave rise. An extract from his speech on this occasion, will serve the double purpose of showing the manly independence of his sentiments, and the peculiarity of his style of oratory. "Let us not flatter ourselves," he said: "who will give subsidies if your king may impose what he will; and if, after parliament, the king may enhaunce what he pleaseth? I know your king will not do it; I know he is a religious king, free from personal vices; but he deals with other men's hands, and sees with other men's eyes. Will any give a subsidy that will be taxed after parliament at pleasure? Your king cannot tax by way of loans. I differ from those who would have this of *loans* go amongst grievances; but I would have it go *alone.* I will begin with a noble record: it cheers me to think of it—25 Edward III.; it is worthy to be written in letters of gold. Loans against the will of the subject are against reason, and the franchises of the land, and they desire restitution. What a word is that franchise? The lord may tax his villain high and low, but it is against the franchises of the land for freemen to be taxed but by their consent in parliament. Franchise is a French word, and in Latin it is *libertas.* In *Magna Charta* it is provided that: *Nullus liber homo capiatur, vel imprisonetur, aut disseisietur de libero tenemento suo, &c., nisi per legale judicium parium suorum, vel per legem terræ.** Which charter hath been confirmed by good kings above thirty times."

The result of this debate was a vote of the house declaring: "That it is the ancient and indubitable right of every freeman, that he hath a full and absolute property in his goods and estate; that no tax, tallage, loan, benevolence, or other like charge, ought to be commanded or levied by the king, or any of his ministers, without common consent by act of parliament."

Before this spirited declaration of the house had been made, some persons who had refused to obey the order for a loan had been committed to prison, solely on the king's order; the privilege of the *habeas corpus* had formally been disallowed them by the courts, and it had been declared that a person confined by the royal authority could not be bailed. On this subject Sir Edward Coke expressed himself thus: "What is this," said he, "but to declare upon record that any subject committed by such absolute command, may be detained in prison for ever? What doth this tend to, but the utter subversion of the choice, liberty, and right belonging to every free-born subject of this kingdom? I fear, were it not for this parliament that followed so close after the form of judgment was drawn up, there would have been hard putting to have had it entered; but a parliament brings judges, officers, and all men into good order." The discussion being resumed on a subsequent day, in the course of his speech, Coke said: "It is a maxim, the common law hath admeasured the king's prerogative, that in no case it can

* No freeman shall be taken, or imprisoned, or deprived of his freehold, but by the lawful judgment of his peers, or the law of the land.

prejudice the inheritance of the subjects. Had the law given the prerogative to that which is taken, it would have set some time to it, else mark what would follow. I shall have an estate of inheritance for life or for years in my land, or propriety in my goods, and I shall be tenant at will for my liberty: I shall have propriety in my own house, and not liberty in my person. *Perspicue vera non sunt probanda.* The king hath distributed his judicial power to courts of justice and to ministers of justice. It is too low for so great a monarch as the king is to commit men to prison; and it is against law, that men should be committed, and no cause shewed. I would not speak this, but that I hope my gracious king will hear of it: yet it is not I, Edward Coke, that speaks it, but the records that spake it. We have a national appropriate law to this nation, *divisis ab orbe Britannis.* I will conclude with the Acts of the Apostles, ch. 25. *It is against reason to send a man to prison, and not to show the cause.*"

After this speech, on the question being put, it was resolved:

I. That no freeman ought to be detained or kept in prison, or otherwise restrained by the command of the king, or privy council, or any other, unless some cause of the commitment, detainer, or restraint be expressed, for which by law he ought to be committed, detained, or restrained.

II. That the writ of *habeas corpus* may not be denied, but ought to be granted to every man that is committed or detained in prison, or otherwise restrained, though it be by the command of the king, the privy council, or any other, he praying the same.

III. That if a freeman be committed or detained in prison, or otherwise restrained by the command of the king, privy council, or any other, no cause of such commitment, detainer, or restraint, being expressed, for which by law he ought to be committed, detained, or restrained, and the same be returned upon a *habeas corpus* granted for the said party, then he ought to be delivered or bailed.

Sir Edward Coke joined in framing not only these, but several other spirited remonstrances which the king's arbitrary conduct called forth from the representatives of the nation; and it is well known that they were not contented with remonstrances alone. The *Petition of Rights* was their work; and for this celebrated statute, which forms one of the proudest epochs in the history of the English constitution, we are partly indebted to his exertions. He was also principally instrumental in procuring that earnest remonstrance against the Duke of Buckingham, which was in effect directed against all the measures that had been pursued by the ministry. Shortly afterwards, the session of parliament was brought to a close, and with it finished his public career.

The remainder of his life was spent in retirement, chiefly at his house at Stoke-Pogies, in Buckinghamshire, where he enjoyed that high consideration and respect to which his talents, his character, and his station in society justly entitled him. But even in his last retirement his active mind was not without employment; and it may reasonably be conjectured that a great part of his time was devoted to the revisal of the works he left behind him unpublished. To the end of his life, though secluded from politics and from the world, he was looked upon by the court with an eye of jealousy and suspicion. While he was on his death-bed, his house was searched for seditious writings, and his numerous manuscripts, together with his will, were carried away. The former were not restored to his family till ten years afterwards; and the latter was never given up. He closed his long and useful career (September 3rd, 1634,) exclaiming in his last moments: "Thy kingdom come, thy will be done." His remains were interred in the church of Titeshall in Norfolk, the family burial place of the Coke family.

Sir Edward Coke was gifted with the advantages of a fine person and commanding appearance. The bust of him which is preserved in the library at Trinity College, Cambridge, and the portrait which hangs in the hall of Lyon's Inn, represent him as having handsome and regular features, with a gravity of countenance to which the costume of his time, and particularly the long pointed beard, did not a little contribute. He was at all times particularly attentive to his apparel and general personal appearance, holding it for a maxim that the exterior neatness of the body ought to be emblematic of the inward soul's purity. It may be considered perhaps a proof rather of his honest pride in having fearlessly performed his duty, than of his taste for show and ornament in dress, that he refused to part with his

judge's collar on his removal from the bench, alleging as his reason, that he would leave it to his posterity for a memorial that they had a chief justice among their ancestors. He used to boast that all his honours had been obtained without bribery or solicitation *(nec prece nec pretio,)* and would often give solemn thanks to God that he never gave his body to physic, his heart to cruelty, nor his hand to corruption. In his habits and manner of living Coke appears to have indulged in a little eccentricity. He was more exclusively a lawyer than most of his contemporaries, who were wont to relax from their severer studies in the occasional pursuit of lighter and more agreeable occupations. Music, dancing, fencing, and all the minor accomplishments considered necessary to perfect the education of a gentleman, were in his time regularly taught in the inns of court, which were placed very much on the same footing as our universities are at present; the members, and particularly the students, being subjected to many other restraints, besides that of attending hall during term, now almost the only remaining vestige of academical discipline. We are not informed that Coke at any time distinguished himself (as many great lawyers have done) in the diversions and entertainments so frequently presented by the members of the inns of court. Indeed, his mind appears not to have been endowed in any degree with the attribute of versatility; and the study or practice of the law engrossed all its energies. If he ever wandered from it, divinity became his theme. Every hour of his time was regularly and systematically apportioned; a method of which those only who have felt the pressure of constant and various employment can fully appreciate the advantages. The six hours of sleep (with which in one of his incidental snatches of advice to his readers, he enjoins the student of law to content himself,) he used to enjoy at a very extraordinary season, making it his constant practice to retire to rest at nine o'clock, and to rise at three. To this custom he was so habituated, that if disturbed during that period he was totally unfit for business all the remainder of the day; insomuch that, if we can rely on the information of his grandson, Roger Coke, his son refused to awaken him before his usual time, even on the arrival of an important express from the king. It is probable that to this extreme regularity of life he was in great measure indebted for the health and longevity he enjoyed.

His family consisted of seven sons and five daughters, two of the latter being by his second wife. The fortune which he left behind him, increased as it had been by two advantageous marriages, by the successful exercise of his profession, and by habits of frugality, was very large; and his descendants have ever since his time been among the most wealthy of the gentry of England. During the reign of George I. his lineal representative in the male line was raised to the peerage, with the title of Baron Lovell, and he afterwards became Viscount Coke and Earl of Leicester. This title now no longer exists, but the present head of the family, Thomas Coke, Esq. of Holkham, in Norfolk, in point of wealth and consequence, may rank with the first commoners of this realm.

After what has been related of Sir Edward Coke's life, it is needless to expatiate on his character. His temper was evidently violent, and his disposition overbearing. In the early part of his career, there were no bounds to his obsequiousness: after he had attained the object of his ambition, it has been seen that his conduct was any thing but that of a servile courtier; a contradiction that can only be accounted for, by supposing him to have been gifted by nature with an independent spirit, between which and his ambition there was a continual struggle. The former, however, ultimately gained the ascendancy; and (to use the expressions of Mr. Hallam) "he became, not without some honourable inconsistency of doctrine as well as practice, the strenuous asserter of liberty, on the principles of those ancient laws which no one was admitted to know so well as himself; redeeming in an intrepid and patriotic old age, the faults which we cannot avoid perceiving in his earlier life."

It has been elsewhere observed of Coke: "His advancement he lost in the same way he got it—by his tongue: so difficult is it for a man very eloquent not to be over-loquent. Long lived he in that retirement to which court indignation had remitted him, yet was not his recess inglorious; for at improving a disgrace to the best advantage he was so excellent, as King James said of him, *he was like a cat, throw her*

*which way you will she will light upon her feet.* And finding a cloud at the court he made sure of his fair weather in the country, applying himself so devoutly to popular interest, that in succeeding parliaments the prerogative felt him as her ablest, so her most active opponent."

The patriotism and independence of Sir Edward Coke must ever be considered as the brightest feature in his character. It is as a patriot alone that he stands superior to his great contemporary Bacon, with whom throughout the greater part of his professional career he was placed in constant competition. Both had embraced the same profession, both prosecuted it with ardour and success; one attaining the highest, the other the second dignity it can confer; and both lived to experience the instability of the preferment they had struggled so hard to acquire. But the causes which produced the downfal of these illustrious persons were widely different; and he whose integrity was unimpeached rose highest in public estimation after his disgrace at court; while all the brilliant qualities of his rival, when sullied by corruption, failed to procure him the consideration and esteem that to a generous mind form the most gratifying reward of every exertion. As an author, however, Bacon need fear no comparison with Coke. No one can peruse a production, however slight, of each, without being struck by the wide disparity of their intellects. Bacon was in every respect superior to his age; Coke was merely on a level with it: the former was a philosopher, a statesman, and a lawyer; the latter was a lawyer, and little or nothing more. An absurd opinion is sometimes maintained, that those who devote themselves to the study of the legal profession must sedulously refrain from intercourse with every other department of literature and science. Perhaps no more striking refutation of such a doctrine can be named, than the great superiority of Bacon's legal writings over those of his contemporary. As a practical lawyer, Coke was undoubtedly without an equal. All the abstruse learning of the common law, the subtle niceties of pleading, and the voluminous enactments of the statute-book, were treasured in his memory; and from this copious repertory he could always draw wherewithal to supply the emergencies of a particular case. But he wanted the lamp of philosophy to enlighten the confusion of so many jarring elements. It would have produced such an effect as the first beaming of day is said to have done on chaos; for though in a confined circle he could move with safety, if not with freedom, he was bewildered and lost when he ventured beyond it. His mind resembled a spacious but ill constructed dwelling-house, stored with furniture in abundance and of costly workmanship, which, however, for want of order and arrangement, is deprived of much of its utility, and is often found to be more cumbersome than convenient. The difference we cannot fail to perceive between these distinguished individuals was owing as much to the original dissimilarity of their genius, as to their education and acquired habits of thinking: Coke had not been nurtured in the school of philosophy; and having once fallen into the beaten track of the law, he seems never to have felt a wish to diverge from it: although endowed with a shrewd and penetrating mind, he loved rather to involve himself in the perplexities of detail, and to treasure up a vast number of unconnected facts, than by arranging and combining these, the elements of knowledge, to discover new and hidden truths. He possessed a memory at once powerful and capacious; industry, which no labour could fatigue, and that sobriety and dispassionate temper of mind which no intricacies could disgust, but he was lacking in the higher and more noble faculty of reason, which is the true and only source of all philosophy. In this his great rival, the father of philosophy, eminently excelled; and while Bacon was gaining by a broader and easier ascent, the vantage ground of his profession, he found leisure to indulge the natural versatility of his tastes, and to make those excursions into the fields of literature and of science, by which his fame has become the property of the world. In none of Coke's writings do we find a single attempt to generalize, to discover those great principles of jurisprudence from which most of the principal enactments of positive law have been deduced, or to lay down rules for the guidance of future legislators. He is content to know that certain regulations have been made, and that certain consequences must follow; but he goes no further, or if

he attempts to do so, he wanders without a compass. No one, who has perused even the speech of Lord Bacon, on his taking his seat in the Court of Chancery, will require to be told that his manner of treating legal subjects is very different.

It is true that the voluminous writings of Coke have always been classed among the most important that we possess on the laws of this country. "His learned and laborious works on the laws," says Fuller, "will be admired by judicious posterity, while fame has a trumpet left her, and any breath to blow therein." But this eulogium must not be understood to imply that they are worthy to be looked up to as models for imitation, either in point of style or method. Their chief merit consists in the extensive learning and sound legal information which they contain; but this is imparted in such a negligent and slovenly manner, as greatly detracts from their value. They resemble a garden filled with the choicest flowers, which, however, are frequently disfigured or concealed by the neighbourhood of weeds and rubbish. That want of order and arrangement, which is their principal fault, seems to have arisen not so much from mere carelessness and inadvertence in the disposition of the subjects to be discussed, as from the peculiar habit of Coke's mind, which made him ever more anxious to exhibit his powers of subtlety and copious illustration in reasoning, than to produce only such arguments as might be apposite and well timed. Hence his digressions are not only frequent but almost interminable; and his arguments are often heaped together till they become tiresome and even puerile. It appears that he was reproached with committing exactly the same faults in extemporaneous speaking. Lord Bacon expresses himself thus on the subject: "In discourse you delight to speak too much, not to hear other men. This, some say, becomes a pleader, not a judge; for by this sometimes your affections are entangled with a love of your own arguments, though they be the weaker, and rejecting of those which, when your affections were settled, your own judgment would allow for strongest. Thus, while you speak in your own element, the law, no man ordinarily equals you; but when you wander, as you often delight to do, you wander indeed, and give never such satisfaction as the curious time requires. This is not caused by any natural defect, but first for want of election, when you, having a large and fruitful mind, should not so much labour what to speak, as to find what to leave unspoken: rich soils are often to be weeded. You cloy your auditory when you would be observed; speech must be either sweet or short."

A few examples shall be given of these defects in the works of Sir Edward Coke. The first that occurs will sufficiently illustrate his manner of digressing, his mania for assigning a reason to every thing, and also the particular tone of quaint pedantry which was in some degree the characteristic of his age. It is taken from his Commentary on Littleton. The author having enumerated the different kinds of tenures and services in the following order: *viz.* homage fealty, escuage, knight's-service, frankalmoigne, homage auncestrell, grand serjeanty, petit serjeanty, tenure in burgage, in villanage, and rents, Coke cannot but find something peculiarly appropriate in the arrangement of these heads. After commenting on the four first, he goes on: "Fifthly, *soccage*, the service of the plough, aptly placed next knight's-service, for that the ploughman maketh the best souldier, as shall appeare in his proper place. Sixthly, *frankalmoigne*, service due to Almighty God, placed towards the middest for two causes; first, for that the middest is the most worthy and most honourable place; and, secondly, because the first five preceeding tenures and services, and the other six subsequent must all become prosperous and usefull, by reason of God's true religion and service; for *Nunquam prospere succedunt res humanæ, ubi negliguntur divinæ*. Wherein I would have our student follow the advice given in these ancient verses for the good spending of the day:

"Sex horas somno totidem des legibus æquis,
Quatuor orabis, des epulisque duas;
Quod superest ultrà sacris largire camœnis."

Co. Litt. 288. a.

Notwithstanding his undisguised contempt for "rhyming poets," this is not the only occasion on which he has thought proper to introduce scraps of Latin verse, and even doggrel, into his legal discussions. Thus, in the following passage: "If the wife elope from her husband, that is, if the wife leaves her husband and tarrieth with her adulterer, she shall lose her dower until her husband willingly, without coercion

ecclesiastical, be reconciled to her, and permit her to cohabit with him; all which is comprehended shortly in two hexameters:

"Sponte virum mulier fugiens, et adultera facta,
Dote suâ careat, nisi sponsi sponte retracta."
Co. Litt. 32. a. 32. b.

Of his very clumsy and inappropriate mode of introducing quotations in his legal writings, it would be difficult to find a more ludicrous example than the passage which occurs in the beginning of his chapter on the jurisdiction of forest courts. (Inst. iv. chap. 73.) "Seeing we are to treat," he says, "of matters of game and hunting, let us (to the end we may proceed the more cheerfully) recreate ourselves with the excellent description of Didoe's doe of the forest wounded with a deadly arrow stricken in her, and not impertinent to our purpose."

Uritur infelix Dido, totâque vagatur
Urbe furens, qualis conjectâ cerva sagittâ,
Quam procul incautam nemora inter Cressia fixit
Pastor agens telis, liquitque volatile ferrum.
Inscius: illa fugâ sylvas saltusque peragrat
Dictæos, hæret lateri lethalis arundo.*

And in a marginal note he compares this wound of the stricken doe to "an evil conscience in the false and furious officer of the forest, if any such be."

His constant disposition to account for every thing by uncommon and singular reasons, is nowhere better exemplified than in his derivations of words. Thus: *Parliament*, he says, is so called, "because every member of that court should sincerely and discreetly *parler la ment* for the general good of the commonwealth." (Co. Litt. 110. a.) "The word *placitum* is derived *à placendo, quià benè placitare super omnia placet;* and it is not, as some have said, so called *per antiphrasin, quià non placet.*" (Ibid. 17. a. 303. a.) "Towne (ville) *villa, quasi vehilla, quod in eam convehantur fructus.*" (Ibid. 115. b.) "ROBBERIE. *Roboria*, properly is when there is a felonious taking away of a man's goods from his person; and it is called robberie, because the goods are taken as it were *de la robe*, from the robe, that is, from the person; but sometimes it is taken in a larger sense." (288. a.) A hundred other such instances might be quoted.

Perhaps there is no quality more conspicuous throughout the writings of Coke than a constant parade of scholastic pedantry. He seldom discusses a subject, however unimportant, without dividing it according to rule under several distinct heads; and it by no means unfrequently occurs that his awkward attempts to establish complete perspicuity create confusion and perplexity where none existed before. It is evident that he was unconscious of this failing. In his preface to the seventh report he says: "In these and the rest of my reports I have (as much as I could) avoided obscurity, ambiguity, jeopardy, novelty, and prolixity. 1. Obscurity; for that it is like unto darkness, wherein a man for want of light can hardly with all his industry discern any way. 2. Ambiguity; where there is light enough, but there be so many winding and intricate ways, as a man for want of direction shall be much perplexed and entangled to find out the right way. 3. Jeopardy; either in publishing of any thing that might rather stir up suits and controversies in this troublesome world than establish quietness and repose between man and man; (for a commentary should not be like unto the winterly sun, that raiseth up greater and thicker mists and fogs than it is able to disperse;) or in bringing the reader by any means into the least question of peril or danger at all. 4. Novelty; for I have ever holden all new or private interpretations or opinions, which have no ground or warrant out of the reason or rule of our books or former precedents, to be dangerous and not worthy of any observation, for *periculosum existimo quod bonorum virorum non comprobatur exemplo.* 5. Prolixity; for a report ought to be no longer than the matter requireth; and as *languor prolixus gravat medicum, ità relatio prolixa gravat lectorem.*"

The scholastic method of argument is often clumsily, and sometimes incorrectly, employed by Coke. He was in the habit of falling into that dangerous error, so common among those who use the mechanism of reasoning somewhat carelessly, of being misled by mere verbal subtleties; and in consequence of this failing his style of arguing is not only often loose and perplexed, but

* These lines are thus translated by Dryden. (Æneis, book iv.)
Sick with desire, and seeking him she loves,
From street to street the raving Dido roves,
So when the watchful shepherd, from the blind,
Wounds with a random shaft the careless hind,
Distracted with her pain, she flies the woods,
Bounds o'er the lawn, and seeks the silent floods
With fruitless care; for still the fatal dart
Sticks in her side, and rankles in her heart.

occasionally vicious. Instances of this sort may be found in his report of Calvin's case, which also contains examples of the defect before mentioned. The principal question of law brought under the consideration of the court in that celebrated cause was: whether the plaintiff, who had been born in Scotland, after the crown of England had descended to James I., was an alien born, and consequently disabled from bringing any action real or personal for lands within the realm of England. It was observed that there were four nouns, which might be called *nomina operativa,* in the plea, *viz.*: *ligeantia,* (allegiance,) *regnum,* (kingdom,) *leges,* (laws,) and *alienigena* (alien.) Each of these subjects underwent a separate discussion. On coming to the last, the reporter observes: "Now we are in order come to the fourth noun (which is the fourth general part) *alienigena*: wherein six things did fall into consideration. 1. Who was *alienigena,* an alien born by the laws of England? 2. How many kinds of aliens born there were? 3. What incidents belonged to an alien born? 4. The reason why an alien is not capable of inheritance or freehold within England? 5. Examples, resolutions, and judgments reported in our books in all successions of ages, proving the plaintiff to be no alien. 6. Demonstrative conclusions upon the premises, approving the same." After examining the first five points at some length, he comes to the last head, which, he says, comprises "six demonstrative illations or conclusions, drawn plainly and expressly from the premises." Among these six arguments, it does not require much penetration to discover the unsoundness of the following.

"Every stranger must at his birth be *amicus* or *inimicus;* but Calvin at his either birth could neither be *amicus* nor *inimicus*: *Ergo,* he is no stranger born. *Inimicus* he cannot be, because he is *subditus;* for that cause also he cannot be *amicus* · neither now can Scotia be said to be *solum amici,* as hath been said.

"Whatsoever is due by the law or constitution of man may be altered: but natural liegeance or obedience to the sovereign cannot be altered: *Ergo,* natural liegeance or obedience to the sovereign is not due by the law or constitution of man. Again, whatsoever is due by the law of nature cannot be altered; but liegeance and obedience from the subject to the sovereign is due by the law of nature: *Ergo,* it cannot be altered."

The false positions contained in these arguments are not the less glaring for being delivered under the form of syllogisms. It will be remarked that in each of them the *minor* is open to exception. The whole of Calvin's case is an excellent specimen of the pedantry with which not only Coke himself, but by far the greater portion of his legal brethren were infected; and if any one would form an opinion of the cumbrous and unprofitable learning with which lawyers in those days were wont to load their discourses, he can do no better than read it in Coke's report. It was an occasion of very great display, as appears by his account of the vast interest excited, and the elaborate discussion it underwent. All the fourteen judges, (there being then five in both the King's Bench and Common Pleas,) with the Lord Chancellor Ellesmere, argued it, apparently at much length, for only two were heard in each of the eight days during two successive Terms that the debate lasted. Every judge took his own course, as Lord Coke informs us; and yet he confesses there was not much difficulty in the case, but that its importance only made the judges of the King's Bench carry it into the Exchequer chamber, where thirteen of the fourteen were, with the chancellor, clear one way. It was evidently made the occasion of an exhibition, a grand legal exercitation, much to the taste of those times. Now, not only is the discussion filled with the most useless and inapplicable learning, but there is really very little that can be called argument in it. Farfetched analogies, quaint allusions, quibbles upon words, quotations from the scripture and from profane authors, both classical and legal, abound in it; but there is a total want of close reasoning upon principle where principles are introduced. Its only value now lies in the remarks made incidentally upon other points of law foreign to the case at bar.

It is impossible to mention this celebrated case without noting the great interest which the argument upon it, especially from the bench, appears to have excited in Westminster Hall, and the enthusiasm with which Lord Coke regards it in his report. He seems quite elevated with conscious satisfaction and professional pride when he

considers how eminently the judges had distinguished themselves; and speaks as one, not merely relating a very important decision in the law, but as one recording a great triumph of the science and its professors. "It was observed," he says, "that there was not in any remembrance so honourable, great, and intelligent an auditory at the hearing of the arguments of any Exchequer chamber case, as was at this case now adjudged. It appeareth that *juris prudentia legis communis Angliæ est scientia socialis et copiosa;* sociable, in that it agreeth with the principles and rules of other excellent sciences, divine and humane; copious, for that *quamvis ad ea quæ frequentius accidunt jura adaptantur;* yet in a case so rare, and of such a quality, that loss is the assured end and practice of it, (for no alien can purchase lands but he loseth them, and *ipso facto* the king is entitled thereunto, in respect whereof a man would think few men would attempt it,) there should be such a multitude and farrago of authorities in all successions of ages, in our books and book-cases, for the deciding of a point of so rare an accident." This may serve as a specimen of the manner in which Coke's enthusiasm for the law is wont incidentally to display itself in his writings.

Although Lord Coke doubtless reckoned the account of Calvin's case his masterpiece as a reporter, deeming the argument itself the first sample of juridical learning and ingenuity, there are many of his cases in every respect far more worthy of commendation. If one were to be selected for the subtlety of the argument, and indeed the importance of the principles to the law, it perhaps would be that of Shelly; nevertheless, this too is disfigured by very puerile matter. For instance, when to prove that the date of the use must be referred to the recovery suffered, and not to the execution of the use, reference is made to the case of a man while insane giving himself a deadly wound, and afterwards dying while in his senses, which is by many authorities shown not to make him *felo de se;* a thing so self-evident that we are left in doubt, whether most to admire the serious foolery of those who could gravely discuss and decide it, or of those who could cite it for a purpose so foreign. Perhaps, however, upon the whole, Chudleigh's case may be taken as the best example of legal acuteness in those who argued it. Although not above twenty years before the case of the *Postnati,* it should seem that the taste of the bar had been much infected with the growing pedantry of the times during that interval.

If, indeed, we merely look to the merits of the *Reports,* it is not to any of the great cases, the renowned names, that we should resort. Beside those which have been cited, Corbet's and Mildmay's, Taltarum's, Mary Portington's, Clue's, Albany's, are all more or less open to the charge of prolixity, though very much less liable to it than the more celebrated ones of Shelly and Calvin. But the less pretending ones, which shortly give the resolutions of the court upon certain questions, and with little or no argument beyond what is necessary to explain the decision and its grounds, afford by far the best specimen of the learned reporter's talents for abstracting and recording. Indeed, the vast number of points resolved in these cases, and the generality with which they declare the law independent of peculiar facts, and unincumbered of those circumstances denominated by Lord Eldon *specialties,* after the language of the Scottish bar, present a most remarkable contrast to the decisions of modern times, wherein it is oftentimes hardly possible to arrive at a rule through the maze of details and qualifications that beset the course of the judgment.

It must not, however, be supposed that every short notice of a case in the Reports is free from learned lumber and extravagance. The case of Swans is little enough in bulk, and trifling enough in import, yet is it sufficiently chequered with nonsense, hardly exceeded by the *case of Mares* in Scriblerus's Reports. "The truth of the matter was that the Lord Strye had certain swans which were cocks, and Sir J. Charlton certain swans which were hens, and they had cignets between them; and for these cignets the owners did join in one action; for by the law the cignets do belong to both owners in common equally, *sc.* to the owner of the cock and the owner of the hen, and the cignets shall be divided betwixt them. And the law thereof is formed on a reason in nature, for the cock swan is an emblem or representative of an affectionate and true husband to his wife above all other fowls; for the cock

swan holdeth himself to one female only, and for this cause nature hath conferred on him a gift beyond all others; that is to die so joyfully, that he sings sweetly when he dies; upon which the Poet saith

*Dulcia defecta*, &c. &c.

And therefore this case of the swan doth differ from the case of kine and other brute beasts."—*Vide* 7 *Hen*. 4. 9.

But though all Lord Coke's writings are more or less disfigured by such far-fetched and inappropriate arguments as these, it is not to be supposed that he was altogether incapable of reasoning philosophically. It certainly must be allowed that it is not often instances occur in his works of enlarged and comprehensive views, such as the great mind of Bacon delighted to indulge in; but they are sometimes to be met with, His sound and humane remarks on capital punishment, at the close of his third Institute, merit attention, whether we regard the man or the age. "Wofull experience," he says, "has shown the inefficacy of frequent and often punishment to prevent offences. It is a certain rule that those offences are often committed that are often punished; for the frequency of the punishment makes it so familiar as it is not feared." In the margin we then have "*Sta, perlege, plora*," and in the text he continues thus: "What a lamentable case it is to see so many Christian men and women strangled on that cursed tree of the gallows; insomuch as if in a large field a man might see together all the Christians, that but in one year throughout England come to that untimely and ignominious death, if there were any spark of grace or charity in him, it would make his heart to bleed for pity and compassion." He then lays down the rules of "preventing justice," and at the head of these he places "*the good education of youth*." Another is the granting pardons very rarely; and the third, the execution of good laws, though this he deems inferior to education.

Having now adverted to the most conspicuous faults and peculiarities which equally pervade all Coke's writings, it will be proper to give some account of his different works. The first in the order of time was the first part of his Reports, which was published in 1600, while he was attorney-general to Elizabeth. It is entitled "Reports of Sir Edward Coke, Knight, her majesty's attorney-general,* of divers resolutions and judgments given with great deliberation by the reverend judges and sages of the law, of cases and matters in law which were never resolved or adjudged before: and the reasons and causes of the said resolutions and judgments, during the most happy reign of the most illustrious and renowned queen Elizabeth, the fountaine of all justice, and the life of the law." To this report, ten more parts were added during his lifetime, the last in 1615, while he was chief justice of the King's Bench under James I; and after his death two supplementary books of them were published. These, however, not having been revised by the author himself, are not held in such high estimation as those which made their appearance during his lifetime. It has been already stated that on the disgrace of Sir Edward Coke, he was enjoined by the king to pass the summer vacation in correcting his Reports; "wherein," as James affirmed, "there were many dangerous conceits of his own uttered for law, to the prejudice of his majesty's crown, parliament, and subjects." After three months' deliberation, Coke gave in a list of such errors as he had detected; but as they were for the most part merely verbal inaccuracies, such as could in nowise support the charge intended to be brought against him, five special cases were selected by the king's order for that purpose. Sir Edward, however, answered all the objections that could be made against them in such a manner, as to satisfy all who understood the points in dispute; and, indeed, it appears that his legal adversaries, whatever might be their personal enmity towards him, or their deference to the commands of the king, were ashamed of the task imposed on them. Lord Chancellor Ellesmere, in particular, whose temperate conduct throughout the whole of the proceeding was highly creditable to him, was exceedingly anxious to be excused from it. "All that I have done in this," he wrote, "hath been by your majesty's commandment and direction, in presence of all your learned council, and by the special assistance and advice of your attorney and solicitor. I

* This, it will be remarked, is not quite a correct designation, since he was not knighted till after the accession of James I.

know obedience is better than sacrifice; for otherwise I would have been an humble suitor to your majesty to have been spared in all service concerning the lord chief justice." Nevertheless, though the charge was dropped for the time, it was renewed after Coke's alliance with Buckingham, while Bacon was lord keeper. But as Sir Edward openly demanded that the matter might be investigated by the twelve judges, and that they might certify at the same time what cases he had published "for the maintenance of the royal prerogative and benefit, for the safety and increase of the revenues of the church, and for the quieting of men's inheritances, and the general good of the commonwealth," his enemies thought it most prudent to avoid the inquiry altogether.

Bacon himself has said: "Had it not been for Sir Edward Coke's Reports, (which, though they may have errors, and some peremptory and extrajudicial decisions more than are warranted, yet they contain infinite good decisions and rulings of cases,) the law by this time has been almost like a ship without ballast; for that the cases of modern experience are fled from those that are adjudged and ruled in former time."

In 1614, Sir Edward Coke published his "Booke of Entries," and his first Institute, or Commentary on Littleton appeared in 1628. His other works were not published till after his death. They consist of his "Treatise of Bail and Mainprise," (1637;) his "Complete Copyholder," (1640;) the second, third, and fourth parts of his Institutes, (1642, 1644;) and his "Reading on the Statute of Fines, 27th Ed. I." (1662.)

The first Institute of Sir Edward Coke is a running commentary on a short treatise of tenures written by Littleton, who was a judge of the Common Pleas in the reign of Edward IV. The merit of the original work has ever been warmly acknowledged by English lawyers. Lord Guildford made it a point never to let a year pass without reading it through. Coke himself calls it "the ornament of the common law, the most perfect and absolute work that ever was written in any human science;" and if his testimony be rejected as partial or exaggerated, no one will refuse to acknowledge that Sir William Jones has not gone too far in attributing to Littleton, whom he styles the English lawyer's great master, "luminous method, apposite examples, and a clear, manly style, in which nothing is redundant, nothing deficient." The commentary cannot boast of the same qualities. Strictness of method was not indeed very compatible with the nature of such a work; but the constant digressions of the annotator, of which some few examples have already been given, are multiplied to an extent that must deprive the commentary of all claim to that systematic arrangement, and severe concision, which ought to be considered indispensable in every elementary treatise. The fact is, as Blackstone has well observed, that Coke's Institutes have very little of the institutional method to warrant such a title, and that this commentary, though a rich mine of valuable common law learning, is particularly remarkable for its deficiency in method. Coke himself says, "I have termed them Institutes, because my desire is they should institute and instruct the studious, and guide him in a ready way to the knowledge of the national laws of England. This work (speaking of the Commentary on Littleton) we have called the first part of the Institute, for two causes: first, for that our author is the first book that our student taketh in hand: secondly, for that there are some other parts of Institutes not yet published, *viz.* the second part, being a commentary upon the statute of *Magna Charta*, Westminster I., and other old statutes The third part treateth of criminal causes and pleas of the crown: which three parts we have, by the goodness of Almighty God, already finished. The fourth part we have purposed to be of the jurisdiction of courts: but hereof we have only collected some materials towards the raising of so great and honourable a building. We have, by the goodness and assistance of Almighty God, brought this twelfth work to an end: in the eleven books of our Reports, we have related the opinions and judgments of others; but herein we have set down our own." This description of the four Institutes may suffice. It has already been said, that the three last are held in less estimation than the Commentary on Littleton, which is partly on account of their being posthumous works, and partly because the subjects of which they treat are generally speaking more obsolete. The law of real property, which forms the subject

of the first Institute, though it has undergone some considerable changes since the abolition of the feudal tenures in the reign of Charles II, still remains in many respects the same as it stood in the time of Coke; and his commentary is even now looked upon as one of the most copious and authentic sources of information on the subject. The eighteenth edition of this work was published in 1823, being the sixth which has appeared within the period of thirty years; a convincing proof of the value attached to it by modern lawyers. It may also be considered a testimony of the respect which is borne for Sir Edward Coke and his works, that his Reports, instead of being distinguished from other works of the same nature by the addition of the author's name, are invariably styled *The* Reports. Indeed, the astonishing acuteness of his mind, his immense stores of legal learning, and his unwearied industry, peculiarly qualified him to go through the arduous task he imposed on himself, in undertaking the various works which have given him a lasting reputation. Had he lived a century later, it is more than probable that the faults with which his writings are disfigured would have been corrected by the style and the spirit of a more polished age; but even with all his imperfections, he can never cease to be regarded, in every point of view, as one of the most illustrious of the numerous celebrated characters that figure in the annals of the English jurisprudence.

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The Manuscripts of Lord Coke are in the possession of his descendant, Mr. Coke, of Norfolk, whom we have already mentioned as his representative through the female issue of Lord Leicester, the male heir of the chief justice.

At this gentleman's princely mansion of Holkham, is one of the finest collections, or, indeed, libraries of manuscripts anywhere preserved; certainly the finest in any private individual's possession. It partly consists of the chief justice's papers; the rest, and the bulk of it, was collected by that accomplished nobleman who built the mansion, the last male heir of the great lawyer. He had spent many years abroad, where his taste was improved and his general education perfected. He collected a vast number of the most valuable manuscripts. Of these the exquisitely illuminated missals, and other writings of a similar description, which would from their perfect beauty and great rarity bear the highest price in the market, are certainly by far the least precious in the eyes of literary men. Many of the finest *codices* of the Greek, Latin, and old Italian classics are to be found in this superb collection. Among others are no less than thirteen of Livy, a favourite author of Lord Leicester, whom he had made some progress in editing, when he learnt that Drakenborchius, the well known German critic, had proceeded further in the same task, and generously handed over to him the treasures of his library. The excellent edition of that commentator makes constant reference to the Holkham manuscripts, under the name of *MSS. Lovelliana*, from the title of Lovell; Lord Leicester not having then been promoted to the earldom. Mr. Coke, with a becoming respect for the valuable collection of his ancestors, was desirous to have the manuscripts unfolded, bound, and arranged, both with a view to their preservation and to the facility of consulting them. They had lain for half a century neglected, and in part verging towards decay, when he engaged his valued friend, William Roscoe, to undertake the labour so congenial to his taste and habits, of securing these treasures from the ravages of time. From the great number of the manuscripts, the state in which many of them were, and the distance of Mr. Roscoe's residence, this was necessarily a work of time. After above ten years employed on it, the task is now finished. Each work is beautifully and classically bound; and to each Mr. Roscoe has prefixed, in his own fair handwriting, a short account of the particular manuscript, with the bibliographical learning appertaining to it.

But our present purpose is with the small portion of this collection which descended from Lord Coke. A great part of it is in his own handwriting. There are, among others, the original manuscript of the Book of Entries, and of the Reports, in law French. The student may here enjoy the gratification of reading Shelly's case and Calvin's case in the reporter's own hand. But there are also unpublished works of the same illustrious lawyer and patriot. Among these a curious Statistical Account of England has long been known to antiquaries. Another work, much more valuable, if not written by Lord Coke

himself, a supposition which appears to be negatived by internal evidence, especially by the manner of citing the Reports, yet seems to have been well esteemed by him, possibly composed under his direction. Having been favoured with a particular account of its contents, we may render an acceptable service to lawyers by describing them somewhat in detail.

It is a folio MS. of 225 pages, in English, entitled, "*A Treatise concerning the Nobility of England according to the Law of England.*" The following is the opening of the work, written pretty much in the style of the chief justice.

"As in man's body for the conservation of the whole, divers functions and offices of members are required, even soe in all well gouverned commonwealthes, a distincion of persons is necessary. *Nobilitas* generally signifieth, and is derived of the word *nosse*, to knowe, signifying in common phrase of speech both with the Lattines and also with us Englishmen, a generositie of blood; and therefore one said, '*Vir nobilis idem est quod notus et per omnia ora vulgatus.*' A nobleman is hee whoe is knowne and through all the tenor of his life is talked of by many men's mouthes. But especially applyed and used to express the reward of vertue in honourable measure, '*et generis claritatem.*' But my purpose at this tyme is onelie to speake of the nobilitye, and especiallye soe much of them as I find written in the bookes of the common lawes and statutes of the realme."

After some further preliminary matter, he goes through the different titles of honour severally, beginning with that of *prince*, and then passing to *duke*. Under these heads there is much learning upon the dutchies of Cornwall and Lancaster, and the earldom of Chester. Under the head of *earl*, and between that and *viscount*, he enters largely into the law regarding nobles, and specially the subject of *scandalum magnatum*. In the course of this discussion he breaks forth into a vehement invective against libels.

"There is another foule puddle that arriseth from the same corrupt quagmire, and distilleth out of a beastelinesse infected with malice and envie, but is devised and practised by another means than the former, which is by libelling, general slandering, and defaming of another; for this backbiter doeth not by wordes harme his adversary in so manifest and turbulent manner, as the hellewick monster in his fury doth, but seeming to sitt quietly in his studdy doth more deepelie punish him, and infixeth a more deadlie and incurable wound into his fame and credit than the other boysterous fellow doeth in his body, whoe in a moment threateneth to doe more than peradventure he is willing to perform, or dareth to perform in an age."

Under this head we meet with a curious note, as follows:—

"Note—that if a man doth write unto another scandalous words and reports touching a noble-man, and this letter be sealed with his seale and subscribed with his name, yet upon this letter, shewed in evidence, this noble man may recover damages in an action *de scan. mag.* whereof you may see presidents in Crompton; but if a man doe write any matter in defamation to the party himselfe that is thereby traduced, and subscribe and seale the same without other publication done by himselfe—quære."

Certainly there could now be no question in this matter; there being clearly no act of publication to the damage of the party slandered; whereas in the case first put there is plainly a complete publication against the nobleman to a third person, and consequently a manifest damage done. In discussing the application of the maxim, *Possessio fratris facit sororem esse heredem*, to titles of honour, and showing that it extends not to them, he argues etymologically on the meaning of *possessio;* "which," says he, "is no other than *pedis positio*, and can only be of things whereof there is entry." How plainly we perceive, in this as in a thousand instances of Lord Coke's undisputed writings, the tendency of the learned of those days to pass over the obvious and the true derivation, in order to get at some etymon of a fanciful and farfetched kind, which may serve the purpose of his argument! Can any one doubt that *possedere* comes from *posse sedere?*

He next discusses the "Privileges incident to the Nobility, according to the Laws of England." Of these, trial by peers is the first; and under this head he lays it down that bishops have not this privilege, "because they cannot try, and trial is mutual;" a dictum long since overruled.

Exemption from attendance upon

the leet and tourn is the next privilege handled by him; and then the right of having chaplains. Then follows the privilege they have in equity suits, happily abridged by one of Sir Samuel Romilly's acts. This subject is closed with a discussion of the case "wherein a lord of parliament hath noe privilege."

The title of *Baron* is an important and an ample one.—The author treats it under three heads, Barony by Tenure, Barony by Writ, and Barony by Patent. Of these the first is the most curious, and being upon a chapter of the law now become nearly obsolete, it possesses peculiar interest, as containing the doctrine in acceptation among lawyers, in the time when that subject was more familiarly known. The author gives a great number of instances of Baronies by Tenure; tracing the descent or transmission of each in such a line as showed the peculiarity of the territorial holding, and giving tabular schemes of the persons taking a passed one. He then lays down certain canons respecting such honours, restricting exceedingly the powers of the owners of the territory and castle, once the descent of the barony.

Under the head of Baron by Patent, he discusses a subtle question: "If a nobleman and his heirs have for a long time been called to parliament, and be barons by tenure or by writ, and have had in regard thereof a place certain in parliament; if afterwards the same be created a baron of *that* barony, and by the same name, by letters patent; whether shall he and his heirs retain his oulde place in parliament which he had according to the former dignity; or whether should he lose his oulde place, and take a new accordinge to the tyme of his seconde onelie?"

There follows a concluding discussion on "nobilitie or lades in reputacion onelie." "Under this head we have treated, the subject of courtesy and forein ladies—noble women—the postnati of Scotland—and ladies in reputation."

It is certain that this manuscript is well worthy of the attention of the learned; and we venture to hope that Mr. Coke will permit it to be published.

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Further information concerning the life of Sir Edward Coke, and the times during which he flourished, may be gathered from the following works:—

*Biographia Britannica*, art. *Coke;* whence a considerable part of the foregoing narrative has been extracted.

*Bacon's Works;* particularly vol. vii. of Mr. Basil Montagu's edition, which contains most of the letters quoted above.

*State-Trials;* particularly the trials of Essex and Raleigh, the proceedings connected with the powder-plot, and the murder of Sir Thomas Overbury. See also the first volume of Mr. Phillips's excellent "Collection of the most remarkable State Trials."

*Fuller's Worthies.*

*Loyd's State Worthies.*

*Roger Coke's Detection* of the Court and State of England.

*Memorials of Affairs of State*, in the Reigns of Queen Elizabeth and King James I., collected (chiefly) from the original papers of the Right Honourable Sir Ralph Winwood, Knt., sometime one of the principal Secretaries of State. (3 vols. folio, 1725.)

CABĀLĀ, *sive scrinia sacra:* mysteries of state and government in letters of illustrious persons and great ministers of state, as well foreign as domestic, in the reigns of King Henry VIII., Queen Elizabeth, King James, and King Charles. Wherein such secrets of empire, and public affairs, as were then in agitation, are clearly represented, and many remarkable passages faithfully collected. (folio.)

*The Annals of King James and King Charles I.*, both of happy memory, containing a faithful history and impartial account of the great affairs of state, and transactions of parliaments in England, from the tenth of King James, 1612, to the eighteenth of King Charles, 1642. (folio, 1681.)

*Rushworth's Historical Collections* of private passages of state, weighty matters of law, remarkable proceedings in five parliaments. Beginning the sixteenth year of King James, *anno* 1618, and ending the fifth year of King Charles, *anno* 1629. (7 vols. folio, 1659.)

Among modern works, "The Life of Sir Edward Coke," by Mr. Woolrych, of Lincoln's Inn, contains many minute and curious details, drawn from the most authentic sources.

The Histories of Hume and Lingard, the Parliamentary History, and the Journals of the House of Commons may be consulted with advantage, so far as they relate to the proceedings mentioned in the text; and the first volume of Mr. Hallam's Constitutional History of England will also be found to contain much valuable information connected with the subject.

Miss Aikin's "Memoirs of the Court of King James the First," furnish a general account of most of the events that have been touched upon above.

Some curious particulars relative to the marriage of Coke's daughter are given in the first volume of the second series of Mr. D'Israeli's "Curiosities of Literature."

(2)

THOMSON, Katharine

# CARDINAL WOLSEY.

## Chapter First.

*Birth and Parentage of Wolsey.—The Nature of his Early Pursuits.—The Cause of his First Preferment.—His First Transaction in State Affairs.—His Increasing Honours.—Advantages derived by Wolsey from the Events of the War.*

Thomas Wolsey was born at Ipswich, in the month of August, and in the year 1471. His father is generally supposed to have been a butcher, but there is no positive authority for the statement. Great unnecessary importance has been attached to this point by those authors who have written upon the character and actions of this celebrated man. It is sufficient to know that Wolsey had the merit of rising from an obscure station; that he was the son of a poor, but honest man; that his parents possessed the means of educating him respectably; but acquired not, happily for him, the wealth to support him idly;* yet these humble individuals lived perhaps far more usefully and happily in their obscurity, because more respectable, than their unprincipled illustrious offspring.

It was not until two centuries after the birth of Wolsey that any degree of curiosity concerning his origin was manifested by the public. In 1761, it was ascertained by one of his biographers, that the father of Wolsey possessed some property in land, in two parishes of Ipswich; that he bequeathed to his son, Thomas, ten marks to sing a mass for his soul, if he entered into holy orders within a year after his father's death; that he left his lands at the disposal of his wife, Joan; and the rest of his worldly property to his son, his wife, and another person, "to dispose as they should think best to please Almighty God, and to profit his soul."*

At a very early age Wolsey was sent to Magdalen College, Oxford, where he acquired the rare distinction of being a bachelor of arts when he had only reached his fifteenth year. This early honour was remembered by him with the pride and satisfaction with which prosperous men often revert to the first step in their ascent to fame. In his more splendid and wretched days, Wolsey related the circumstance to George Cavendish, one of his gentlemen ushers, who has repeated it in the valuable Memoirs of Wolsey, which he subsequently composed. "He told me, in his own person," says Cavendish, "that he was called the boy bachelor at fifteen years of age; which was a rare thing, and seldom seen." The youthful acquirements of Wolsey, how much soever they may have been admired by his contemporaries, were not of a nature to be highly valued in the present day. The pursuits of a clerical student, in the fifteenth century, were neither adapted to qualify him for offices of state, to which the clergy were, at that time, oftentimes promoted; nor to endow him with the power of reasoning accurately. The Metaphysics, and Natural Philosophy of Aristotle, formerly prohibited, and burned at Paris, by a decree of the Council of Sens. in 1210, had been again received into favour by the schools, chiefly through the exertions of Thomas Aquinas, a theologian of the fourteenth century, employed with other learned, men to translate the works of Aristotle from the Greek and Arabic languages, into Latin.† In the early part of Wolsey's life the reputation of Aquinas

* In the opinion of Wood, (Athenæ Oxonienses, vol. 2, p. 734,) the assertions respecting the vocation of Wolsey's father being that of a butcher, originated with William Roy, the author of a satire upon Wolsey, entitled "A Dialogue between two Priests' Servants, Watkins and Jeffrey," beginning

"Rede me, and be not wrothe,
For I say no thyng but trothe."

The writers contemporary with Wolsey appear to have known little of his origin. Bishop Godwin, in his Lives of the English Bishops, (p. 618,) speaks of Wolsey "as the son of a poor man, or, (as I have often heard,) a butcher." Skelton, poet-laureate in the time of Henry the Eighth, satirizes Wolsey under the appellation of the "butcher's dog." Hall mentions that the populace abused him as the "butcher's son," a term also applied contemptuously to him by Luther, in his Colloquia. Cavendish describes him as an "honest poor man's son."—See Cavendish, edited by Singer, p. 32.

* See the will of Robert Wolsey, in Fiddes's Life of Wolsey. Collections.

† Mosheim's Ecclesiastical History, vol. iii. p. 25.

was at its height, and Wolsey imbibed from education a partiality for the doctrines, and an admiration for the talents, of that great man, by which his subsequent opinions on theological subjects were strongly tinctured. Seconded by the zeal and talents of Aquinas, scholastic learning had gained rapidly in public estimation; while the Biblicists, those who resorted to the writings of the ancient fathers, or to Holy Writ itself, as the sources of divine truths, had declined both in numbers and importance. Hence consequences the most injurious to religion and philosophy ensued. The education of youth was directed to attainments of a superficial character; a fluency of argument, calculated to mislead, but not to convince; a readiness in the use of scholastic terms, and in the practice of unintelligible distinctions, and a skill in imparting to disputation the air of method, and the semblance of abstruse reflection,—constituted, long after the death of Aquinas, the chief accomplishments of young theologians.

Such being the nature of those studies to which the attention of Wolsey was directed, it is not surprising that he should have contracted strong prejudices, and imbibed erroneous opinions, which even the powers of his vigorous and comprehensive mind were unable to correct. In the endeavour to understand and to retain the subtleties and refined distinctions of his great model, Wolsey neglected both the politer branches of learning, and the important acquisition of real religious knowledge, which can be gained from Scripture alone. In those days, a critical knowledge of the Scriptures was, indeed, rarely to be found even in the most celebrated collegiate teachers, who were usually ignorant of the original languages.* Thus, as the historian of Henry the Eighth, Lord Herbert, expresses it, "the learning of Wolsey, which was far from being exact, consisted chiefly in the subtleties of the Thomists, in which he, and King Henry the Eighth, did oftener weary than satisfy one another." To the same cause may be attributed the absence of those higher principles of action, which, had they regulated the conduct of Wolsey, might have rendered his splendid career a source of incalculable benefit to his country.

To pass his days in studious retirement was not, however, the lot of Wolsey, who had the advantage, for such it often proves, of resting entirely upon his own exertions. It must have been an acceptable turn of good fortune to him, after having, by his proficiency in logic and philosophy become a Fellow of Magdalen College, to have been appointed master of the school, in which students, intended to enter that College, were instructed previous to their admission; a practice common at both the Universities,—each College having, in general, some particular school appropriated to it.* Luckily for Wolsey, there were, among his pupils, three sons of Grey, Marquis of Dorset, the collateral ancestor of Lady Jane Grey. To these young noblemen Wolsey proved an able and assiduous instructor; and it is a curious reflection, that he, who in after times became the governor of princes, possessed, in this early period of his life, the forbearance and diligence which render the humble, and often thankless, offices of a teacher effectual. Perhaps the opportunity thus afforded to Wolsey of viewing, in the ingenuous soul of youth, the secret springs of action and the varieties of undisguised passion, may have been the first source of that intimate knowledge of character which was ascribed subsequently to necromancy, by his enemies, from the influence which he gained over the king. Whatever may have been the final benefits of the task thus appropriated to Wolsey, the immediate advantages were both encouraging to him, and creditable.

It happened that he was invited, with his pupils, to pass under the roof of their father the pleasant and "honourable feast of Christmas,"† in which our forefathers, even more than ourselves, were wont to delight. During this vacation, the marquis had ample opportunities of observing the progress of his sons, and was so highly gratified by their proficiency, that he determined to present their tutor with the living of Lymington in Hampshire, a benefice in the gift of the Dorset family, and in the diocese of Bath and Wells. This presentation took place at the departure of Wolsey with his pupils from their paternal abode; and it was the more acceptable

* When Luther, many years after the period of Wolsey's youth, challenged the University of Paris to dispute with him upon a Scripture foundation, not a single person could be met with, qualified to argue upon a system which had become nearly obsolete.—Mosheim, vol. iii, p. 298.

* See Fosbrooke's Monasticon.

† Cavendish's Life of Wolsey, p. 67.

to Wolsey, on account of some pecuniary embarrassments, of no very creditable nature, in which, according to tradition, he was involved. A statement currently reported either during the life, or shortly after the death of Wolsey, affirmed him to have employed, without authority, various sums taken from the treasury of Magdalen College, of which he was bursar, in the erection of the great tower which was completed at that College during his continuance in office: and he is even said to have used violent means to possess himself of the money necessary for that purpose. The details of this transaction have not, however, reached us, and it seems doubtful if there be any foundation at all for reports so injurious to his reputation. It must, however, be observed, that always painful and often unwise as it is, to draw conclusions unfavourable to the motives and actions of our fellow men, there is no reason to infer from the subsequent conduct of Wolsey that his principles of integrity, in relation to pecuniary affairs, were very exact; or that he would not have sacrificed to ambition, or to any object which he had in view, that sense of honour, without which the greatest qualities can neither redeem the character from meanness, nor save the reputation from dishonour.

Wolsey obtained his first church preferment in Oct. 30, 1500, when he had attained his twenty-ninth year.* His ordinary deportment partook, in too great a degree, as far as morality was concerned, of the licentiousness in which the clergy of those times, perhaps more than any other class of men, indulged. It is uncertain for what excess Wolsey at this time incurred a chastisement, which he had neither the wisdom to forget, nor the generosity to forgive. The affair, according to tradition, originated thus: Sir Amias Pawlet, a knight and justice of the peace, residing in the neighbourhood, discovered the Rector of Lymington in a state of drunkenness at a fair, and deemed it essential to punish the offender by placing him in the stocks; and the aspiring Wolsey was obliged to endure that ignominious mode of confinement, which the compassion or refinement of our present notions has almost abolished in our villages. A curious specimen of the manners of the times, where a beneficed clergyman could thus be held up to popular derision, is afforded by this incident, which was deeply felt, and long resented by the delinquent. Many years afterwards, when the Chancellor of England had not the liberality to pardon the insult offered to the Rector of Lymington, he sent for the country magistrate, and, after a severe reproof, commanded him to wait within the precincts of the court, until, at the pleasure of the council, he should be allowed to depart. Sir Amias knew how necessary it was in that age of despotism to bend to circumstances; and contrived to appease the Chancellor, in the course of five or six years, by embellishing the exterior of his own house, situate at the gate of the Middle Temple, with the badges and cognizances of Wolsey, and with a Cardinal's hat and arms.*

Upon the death of the Marquis of Dorset, in 1501, the obscurity of a country parsonage, without hope of preferment, becoming intolerable to Wolsey, he determined to quit his retirement, and to make his essay upon the theatre of the great world. He was soon fortunate enough to obtain the situation of chaplain in the household of Dean, then Archbishop of Canterbury, who extended his favour towards the young churchman, more from regard for his personal qualities, than from any interest exerted in behalf of Wolsey by the few powerful friends of whom he could boast.

Upon the Archbishop's death 1502. he was again deprived of a valuable patron; but the favour of others, or even the superior strength of his own understanding, was not all he had to depend upon. At this early period of his life he possessed that courteous dignity of manner which may be improved by intercourse with polite society, but cannot be imparted by that advantage, when the mind is naturally coarse or frivolous. Combining the accomplishments described by one who has not dealt sparingly with his vices,† "Doctus, et oratione dulcis—Corporis etiam gestu, et habitu concinnus,"‡ Wolsey verified the description given of him by Shakespeare, that "he was fashioned to much honour from the cradle," and displayed in his deportment every thing which inspires regard, and enforces respect. Accordingly we find that he, who was reputed a low and

* Fiddes's Life of Wolsey, p. 6.

* Cavendish, p. 68.

† Archbishop Parker—to whom we owe, in a great measure, the formation of our excellent Liturgy.

‡ See Fiddes, Note, p. 16.

disorderly man at Lymington, acquired the favour of Sir John Nanfan, a "grave and very ancient knight," with whom he chanced to become acquainted. Sir John at this time held the important office of treasurer to the city of Calais, where Wolsey attended him in the capacity of chaplain; but it was not long before the knight, discovering the abilities and industry of his inmate, confided to him almost the entire charge of his public business. This confidence remained unimpaired; and Nanfan, upon his retiring from office on the score of old age, recommended Wolsey to Henry the Seventh in such earnest terms, that the king made him one of his chaplains. Wolsey may now be considered as in the avenue to greatness. There was, indeed, little probability of his attaining, over the mind of that wary and calculating prince, the influence which he afterwards acquired with his successor. Henry the Seventh, perhaps one of the most prudent and successful kings that ever sat upon the British throne, directed all the energies of an acute and active mind to objects of public interest. Approving of literature, he had yet neither sufficient enthusiasm to be fascinated with the wit of Wolsey, nor sufficient knowledge to appreciate his learning. He considered business as the paramount, if not the sole object of importance in life; and he expected in those around him the same assiduity and regularity of habits, of which he gave them the example. His ministers were, as might be expected, laborious and indefatigable servants of the crown, who exercised in their several departments, and required in their inferiors, exactness, steadiness, and dispatch. When they observed that Wolsey, after saying mass in the closet before the king, "spent not forth the day in vain idleness, but gave his attendance upon those whom he thought to bear most rule in the council,"* they naturally gave their confidence to a man who exhibited that self-denial, and power of application, without which no votary of ambition has ever attained pre-eminence in public affairs.

The ministers who chiefly enjoyed the favour of Henry the Seventh were Fox, Bishop of Winchester, and Thomas Howard, Earl of Surrey. Fox had retained his post the longest, and most resembled his royal master in his notions of economical management, which amounted to penuriousness: but Surrey, from his military reputation, and from his office of Lord Treasurer, might be considered the most powerful of these two distinguished subjects. By Fox, the abilities of Wolsey were discovered early, and appreciated justly; and both regard and confidence were manifested by the bishop towards his former dependant, to the latest period of his own existence. Sir Thomas Lovel, master of the king's wards, and constable of the Tower, was another valuable friend, whom Wolsey, by his merits or address contrived to secure among the privy councillors. This knight, who had the character of being both witty and wise, retained his favourable sentiments towards Wolsey until his death; and bequeathed to the object of his early preference, a golden standing cup and four hundred marks of gold, in testimony of his affection.*

Aided by these powerful friends, Wolsey soon obtained an opportunity of displaying his zeal in the service of the king. It was at this time that a treaty of marriage was contemplated between Henry the Seventh and the Duchess of Savoy. It was necessary to treat with Maximilian, Emperor of Germany, the father of the duchess; and a person qualified to undertake this mission was required by the king. Conversing one day upon this subject with Bishop Fox and Sir Thomas Lovel, Henry was persuaded to send for Wolsey, whom his two friends commended in high terms, as possessing the eloquence, address, and prudence necessary to conduct an important and delicate negotiation. Wolsey, on being introduced into the presence of the king, displayed so much discretion and ability, that Henry commanded him to prepare immediately for his journey, and to receive the instructions necessary for his undertaking, from the council. Wolsey resolved to exert his powers to the utmost, in order to secure the favour of the monarch, whom he contrived still further to propitiate in the subsequent interviews, previous to his departure. Having obtained his dispatches, Wolsey, after taking leave of the king at Richmond, about noon, reached London at four o'clock; he proceeded to Gravesend, where he arrived in three hours; hastened from Gravesend to Dover, which he entered on the following morning, just in time to step into the

* Cavendish, p. 76.

* Cavendish, edited by Singer.

passage boats which were under sail for Calais. From Calais he hurried onwards to the emperor, who was at a place not far from that city; and after obtaining an immediate and favourable audience with that exalted personage, he was allowed to depart shortly after the interview. Wolsey now hastened homewards with as much expedition as he could command: his activity met with its due reward; for he succeeded in arriving at Richmond before the king had even dreamed of his having left England. The diligence with which he performed his mission was considered the more remarkable at that time, when travelling was impeded by scanty accommodation, by the danger of highway robbery, and by the badness of the roads; the first act for the regular repair of which was not passed until twenty years afterwards.* The king was so little prepared for the extraordinary promptness of his messenger, that on Wolsey's entering the royal chamber, he began to reprove him for his dilatoriness, in so long delaying his departure. But he, producing the letters of credit which he had brought from the emperor, acquainted Henry with the details of his mission, in which he had somewhat trangressed the limits of his instructions. The king was delighted with the zeal and address of his messenger, and was even pleased with the manner in which, upon his own responsibility, he had ventured to exceed his commission. It was not, however, the habit of Henry the Seventh either to promise lavishly, or to reward liberally, the services of his subjects. With his accustomed reserve, he dissembled his surprise at the quick return of Wolsey; yet it was not long before he recompensed his zeal, by installing him in the Deanery of Lincoln,† at that time the most valuable benefice under a bishoprick; and soon afterwards, the rising churchman was appointed almoner to the king. The incident which procured these distinctions, was probably regarded by Wolsey as extremely conducive to his advancement; for long after it had occurred, when the vicissitudes of his life caused him, perhaps, to dwell with a pleasurable regret upon earlier and happier days, he related to Cavendish the circumstances of his first transaction in state affairs, with a minuteness which has been faithfully copied by that admirable biographer.*

Feb. 1508.

The death of Henry the Seventh, which took place in 1509, had been anticipated by the persons in attendance upon him, for some time before Wolsey was introduced to his notice. That Wolsey, warned by the precarious state of the king's health, endeavoured, before his decease, to insinuate himself into the favour of the heir-apparent, appears probable; for one of the first acts of Henry the Eighth, upon his accession to the throne, was to make the almoner privy-councillor, and to present him with the house and gardens, at Bridewell, in Fleet Street, formerly belonging to Sir Richard Empson, but falling, upon his attainder, to the crown. This mansion, on the site of which Salisbury Square and Dorset Street now stand, was surrounded with gardens, extending to the river, twelve in number, and with orchards corresponding in size. It was for some time the scene of Wolsey's splendour, and of Henry's revels, until the favourite became the possessor of York House, and the builder of Hampton Court and of Esher. But, notwithstanding the favour manifested by this donation, the greatness of Wolsey cannot be said to have commenced immediately upon the accession of the young king. Compelled, for some time, to play a subordinate part in the council, it was his successful endeavour, before attaining any political influence, to secure that secret empire over the mind of his sovereign, which should prove more powerful than either tried capacity or long service. It would not have been practicable for mean abilities to acquire, in any large measure, the esteem of Henry the Eighth, who, before his understanding was undermined by conceit, and cramped by prejudice, was a youth of such promise, that, to use the words of his biographer, had the performance of his riper years answered it, "none of his predecessors would have exceeded him: but as his exquisite endowments of nature engaged him often to become a prey to those allurements and temptations which are ordinarily incident to them, so his courage was observed, little by little, to receive into it some mixture of self-will and cruelty."† The arts by which Wolsey sought to recommend himself, while they flattered the passions of the gay and ardent

* In the fourteenth and fifteenth years of Henry the Eighth. Until the reign of Charles the Second, the roads were repaired by the landholders in the respective counties, upon whom a rate was imposed. ANDERSON's Hist. of Commerce, vol. ii., p. 44.

† Le Neve's Fasti, p. 146.

* Cavendish, p. 77. † Herbert, p. 2.

monarch, were addressed, likewise, to his intellectual qualities. Perceiving the inclination which he betrayed for the pleasures calculated to allure a youth of eighteen, the crafty churchman advised the king to follow the bent of his desires, and to leave the management of state affairs to his councillors, with whom he promised to make arrangements, by which propositions might be reported when they had been digested by older heads, and all the trouble of discussion should have been concluded. At the same time that Wolsey proffered this suggestion, he counselled the king to pursue those studies to which his attention had been directed from his childhood; and especially to continue a diligent perusal of the works of Aquinas, for whose doctrines Henry entertained a lively partiality. With discourses of this nature, Wolsey mingled instructions on the art of government, and disquisitions on important subjects of every nature: so that while Henry regarded him with pleasure as the promoter of his enjoyments, he could not fail to view him with admiration as a politician, and with reverence as a divine. It was, however, no easy task for a man arrived at his period of life, to combine his habits with the ideas and pursuits of a young prince not half his age, who might prefer the society of so many gay and gallant courtiers, all emulously seeking his favour. But Wolsey, with singular address, instead of driving his youthful rivals from the presence of the king, endeavoured to conciliate them by those attractions of wit and eloquence which he possessed in an eminent degree. It is natural for the inexperience of youth to be flattered by every tribute of regard paid to their imagined consequence by those who have outlived the follies, without losing the elasticity, of that fickle age. From those among the male favourites of Henry, who were most endeared to the king by their merits and accomplishments, Wolsey playfully demanded a compact of mutual fidelity and good offices. With the highly-born ladies by whom the court revels were shared and adorned, he was equally solicitous of favour. "Whosoever of them was great, to her he was familiar, and gave her gifts."* He was courteous and liberal to all; he sported, he jested, he sang, he even danced; forgetting, or perhaps holding in lower account, the decorum proper to his sacred habit.

Exertions, so well directed, soon obtained for him such influence at the court, as had not been enjoyed by any minister in the preceding reign. Those who had hitherto employed him as an agent, now sued to him as a superior. The two contending parties in the council quailed before his ascendancy. The Earl of Surrey, who had hitherto seen in him only the humble but useful ally of Fox, now began to fear him as a rival. Fox, who had endeavoured to accelerate his rise in the hope of his aid to resist the encroachments of Surrey, perceived that he had fostered a man so gifted by nature, and so energetic from habit, that he could never be chased from the road to preferment, after he had once entered upon the right track. Such of the nobility and courtiers as had suits to prefer, or were anxious to recommend themselves to the notice of the king, found it expedient to ensure a welcome through the mediation of Wolsey. The court had been little attended during the reign of Henry the Seventh; divisions, resulting from the civil wars, had prevented many of the nobles from presenting themselves to the Lancastrian monarch; poverty had detained some, and the absence of all attraction in an economical and gloomy court, had kept many within their remote but more hospitable mansions. Now the scene was changed, and suitors, long withheld from these various motives, thronged around the king and Wolsey. So plentiful, as Cavendish tells us, were the presents proffered to Wolsey, in order to procure his good offices, that "he wanted nothing, either to please his fantasy, or to enrich his coffers, fortune so smiled upon him; but to what end she brought him, you shall hear."* Meanwhile honours were showered upon him by the king, with a lavish hand; he was presented to several livings of value, in addition to those which he already enjoyed; he was appointed Registrar of the Order of the Garter, and was not 1510. long afterwards intrusted with an office still more active and important, to keep him about the person of the king.

Scarcely was Henry the Eighth seated on the throne, than inducements were held out to him to enter into hostilities against France; and his vanity rendered such propositions too acceptable to be rejected. It would have required, indeed, but little political skill to have preserved the country in that

* Strype's Eccl. Memorials, vol. i. p. 189.

* Cavendish, p. 82.

state of tranquillity in which his prudent father had left it. Ferdinand, King of Spain, was solicitous to remain at peace with England, an union with which had been cemented by the marriage of Henry with his daughter. Maximilian, Emperor of Germany, was too anxious to secure the possessions of Burgundy, and the Low Countries, which he had obtained in right of his wife, to offend so important and warlike a nation as the English. The pope, Julius the Second, sought to secure the alliance of England, which he hoped to engage in his own designs against France. He paid the utmost deference to Henry, to whom he sent a golden rose, dipped in chrism, and perfumed with musk, to be presented to the king at high mass, with the benediction of his holiness. But this emblem of peace and sanctity was accompanied by a letter from the pope, breathing sentiments of the utmost hostility against Louis the Twelfth of France, and representing that monarch as one who, having no regard either to God or to a good conscience, designed to build his own greatness upon the entire conquest of Italy.

Henry the Eighth, like his predecessors of the Lancastrian line, had set out in his career with professions of profound veneration for the holy see. Actuated partly by the necessity of appearing consistent with his declarations, but more by the ambition of signalizing his name as the restorer of the conquered territories in France to the English crown, and by the desire of asserting his title to the throne of France, the gay, impetuous king resolved to attack the dominions of his neighbour, and to take the command of the invading army in person.

It was scarcely probable that Wolsey would oppose a design which must have been so acceptable to the pope, whom, as a churchman, he was inclined by education, and bound by interest, to conciliate. It is at the same time likely that he perceived the folly and inutility of the scheme, which plunged a secure and prosperous nation into unnecessary difficulty and expense. Whatever may have been his secret opinions, he possessed not, in all probability, at this time, influence sufficient to change the course of events; and it is to be feared that he was not disinterested enough to desire it. War was accordingly declared: the league into which Henry entered with Maximilian and Ferdinand, was dignified by the name "*Holy*," although it originated in motives varying widely from the avowed desire of protecting the pope from the incursions of France. Surrounded by all the martial portion of his own subjects, and displaying in his own person youth, strength, and warlike ardour, Henry felt that his triumphs would be adorned, and his anxieties diminished, by the presence of Wolsey, on whose counsels he had learned to depend, and whose society he had begun to think indispensable to his enjoyments. The important, but inglorious office of victualler to the forces was, therefore, conferred upon Wolsey. In accepting it, he at once evinced good sense in disregarding the illiberal sarcasms cast upon his birth, and displayed the variety of his knowledge, and the versatility of his talents, by which he was enabled to undertake business of a nature totally unlike any in which he had hitherto been engaged. He felt, doubtless, the importance of remaining in constant personal communication with the king, who was at an age when impressions are easily made, and swiftly effaced; and he was rewarded for his exertions as victualler, by an appointment of a higher description.

All preparations being at length completed, the king set sail from Dover, on the last day of June, 1512, and after resting a short time at Calais, proceeded to Therouenne in Artois, before which part of the English army had already encamped. Wolsey, with his retinue, followed in the rear, accompanied by the Bishop of Winchester; their united retinues amounted in number to eight hundred men, under the command of Sir William Compton. The place having yielded to the English troops, it was thought expedient to raze it to the ground, excepting the religious houses only; and the victorious army proceeded to invest Tournay, which surrendered, after a short siege. This place, being a bishop's see, having a cathedral, and several churches and monasteries, was deemed worthy of a better fate than that which had been decreed to Therouenne. The interested advice of Wolsey has been assigned as the cause of a preference which seemed directly opposed to good policy. Therouenne, which was near the English pale, might justly be considered as a more valuable fortress than Tournay, an acquisition of comparatively little moment. The indiscretion which sa-

crificed the more important conquest, resulted from the folly of Henry in acceding to the wishes of Maximilian, whose dominions, contiguous to Artois, were frequently annoyed by incursions of the French from Therouenne. Tournay was, therefore, preferred, and was deemed worthy of an English garrison, under the command of Sir Edward Poynings; Wolsey was also made Bishop of Tournay; and he received from the inhabitants, as their pastor, an oath of allegiance to the King of England. Arrangements for its security having been completed, Henry, congratulating himself on having subdued a place famed in history for its resistance to Julius Cæsar, took advantage of his new conquest to hold a solemn feast, which was attended by the Emperor Maximilian, the Duchess of Savoy, and the young Prince of Castile, afterwards Charles the Fifth. These festivities were succeeded by other diversions at Lisle; after which Henry, swelling with the pride of his showy but unprofitable honours, returned to England, followed by the gay and the ambitious, the frivolous and the intriguing throng of courtiers, who had attended his expedition, or flocked to its successful and useless results.

Oct. 1513.

Some time before Wolsey derived the full benefit of his consecration to the Bishoprick of Tournay,* the inhabitants of that city, attached to their former diocesan, and disliking the dominion of a foreigner, resisted the spiritual jurisdiction of Doctor Sampson, whom Wolsey had left in Tournay as his vicar-general; but he finally triumphed over his episcopal adversary, and, by his diligent attention to the business of the town, obtained the chief management of its affairs, and became a popular ruler. This see afforded him considerable revenues, and its citizens treated him almost as a prince, addressing their dispatches "To my Lord Cardinal's grace, and the privy council."† But even higher dignities were reserved for Wolsey on his return to England. The see of Lincoln, vacant on the death of Doctor Smith, became the next step in his ascent to the height which he was destined to attain of wealth and power. This rapid succession of honours and accumulation of riches were insufficient to satisfy the grasping desires of one, who, while he distributed freely, coveted largely the good things of our worldly condition.—Scarcely was the ceremony of his consecration over, before he disgraced his holy office by a successful attempt to possess himself of goods belonging to his predecessor; and Cavendish, repressing, from a sense of justice, his partiality for Wolsey, confesses that he had, at various times, seen the stolen furniture in the house of his master. Tournay and Lincoln were both conferred upon him in the same year; but a yet higher dignity awaited his acceptance: for within a month the archbishopric of York being vacant, he was endowed with the temporalities of that see in August, and was actually translated to it in November. This sudden elevation to the second dignity of the Anglican church, Wolsey owed, no doubt, in part, to one of those accidents which occur in the life of every prosperous individual. Bambridge, the late prelate, was a man in the vigour of life, who held the station of ambassador at the court of Rome, in conformity with the custom then prevalent of employing churchmen in the missions, now more suitably, as well as advantageously, assigned to the laity. The death of Bambridge, which happened suddenly, was attributed to various causes, but it was undoubtedly the effect of poison, administered by some unknown hand, and imputed by common report to his steward, whom he had struck in a fit of passion. A more authentic account unhappily affixes the crime upon Giglis, bishop of Worcester, an Italian, who succeeded Archbishop Bambridge as ambassador at the court of Rome; and the pope, unwilling to throw discredit upon the church, is said to have concealed the dark deed, and to have screened it from punishment.*

Mar. 26, 1514.

Elated by the rapid progress of his fortunes, Wolsey now displayed the arrogance of his character, without fear or scruple. Warham, Archbishop of Canterbury, and at this time lord chancellor, was the first to feel the encroachments by which his brother of York sought to enhance his own dignity, at the expense of the rights of others. It had been the custom, before the elevation of Wolsey, for the cross of Canterbury, borne before the archbishop, on solemn occasions, to take precedence of the cross of York, except within the diocese of York. Great importance

* Strype's Eccl. Memorials, vol. i. p. 172. † Ibid.

* Ellis's Original Letters, vol. i., p. 100.

was attached to this distinction, and in the reign of Edward the Third, a parliament being summoned at York, attendance was refused by the Archbishop of Canterbury upon the plea that the metropolitan of England should not be constrained to lower the emblem of his dignity before the ensign of his brother archprelate.* In defiance of the established usage, Wolsey ordered his cross to be erected, not only within the precincts of Warham's jurisdiction, but even in his presence; nor would he, on the remonstrances of the primate, desist from this act of intrusion. To possess, however, as of right, and not merely by usurpation, and to exercise superiority in all points of worldly greatness, was most agreeable to a man so constituted as the new archbishop, and he resolved to sue for the rank of cardinal, a promotion which he trusted might be followed by the yet higher honours of a legatine commission. Leo the Tenth, who had succeeded Julius the Second in the pontifical chair, was disposed, both from inclination and policy, to bestow the desired honour upon the favourite of a powerful monarch, a dignitary who was likely to reflect credit upon the church. The mode which Leo adopted of forwarding to Wolsey the insignia of his new honours was not, however, approved by the cardinal elect; and being apprised that the "*hat*" was on the road to England, in the charge of a common messenger, or, according to the language of the times, "in a varlet's budget," Wolsey deemed it essential to his dignity that a more honourable means of conveyance should be provided. Previous to the arrival of the papal messenger in England, he was replenished, by the command of Wolsey, with a variety of costly decorations and habiliments, suitable to the importance of his burden. The hat was met on Blackheath by a great number of the clergy, and of gentlemen, and was then conducted to London with great triumph. Meanwhile preparations were made for its reception in Westminster Abbey, where all the bishops and abbots of London and its vicinity were assembled in their richest copes and mitres, in order to celebrate the confirmation of this new dignity to the Cardinal. So solemn was this ceremony, that Cavendish, who was present, declares that he had never witnessed a more imposing scene, except at "the coronation of some mighty prince or bishop."* Nor did the honours of the hat terminate here: in all public processions, it preceded the cardinal wherever he went; when he performed mass in the king's chapel, this emblem of his ecclesiastical degree was placed upon the altar, appearing before the people as an idol, set up by the pride of Wolsey to be worshipped. In this display of his newly-acquired honours, Wolsey had a deeper aim than the mere ostentatious and childish exhibition;—the age was one of ceremony and of pomp; and by a costly exterior, always most admired among a people the least prone to intellectual culture, Wolsey, perhaps, thought to obliterate the remembrance of his obscure origin and sudden rise to power. Unhappily for him the event proved otherwise, and the magnificence of the Cardinal drew upon him the bitterness of popular sarcasm, the secret jealousy of the nobility, and the dislike of the clergy.

Warham, archbishop of Canterbury, had been regarded hitherto as one of the principal persons about the throne, and as one of the most esteemed among the confidential advisers of the King. Austere and averse to new measures, the Primate beheld with chagrin the ascendency of Wolsey, whose conduct towards him was marked by a haughty assumption of superiority. Warham had long held the high office of Chancellor, and had enjoyed much of the late king's confidence. Averse, therefore, in all probability, to play a second part, but alleging his age and infirmities as a plea for his retirement, he resigned the seals, which were immediately offered to Wolsey. The conduct of the Cardinal on this occasion has been variously stated; and even Cavendish reports him to have driven Warham from office by his intrigues. But this statement is incorrect; the resignation of Warham was voluntary, and even his own friends appear to have imputed no blame to his rival and successor. Ammonius, the friend of Erasmus, in writing to that celebrated man, who was warmly attached to Warham, expresses himself thus: "*Your* Archbishop, with the King's good leave, has laid down his post, which that of York, with much importunity, has accepted of, and behaves most beautifully."† The change in this important station was soon fol-

* See note in Singer's edition of Cavendish, p. 90.

* Cavendish, p. 92.

† Cavendish, by Singer. Note, p. 93.

lowed by the temporary retirement of several of the most favoured courtiers, and the resignation of some of the most experienced ministers. The Duke of Norfolk begged permission of the King to withdraw to his country residence; for the embarrassed state of the finances, arising from the lavish expenditure of the Monarch, rendered it difficult for this able statesman and dexterous courtier to play his part, and preserve his reputation, in both characters. Yet the Duke, divided as he was between fear of offending his sovereign, and the risk of ruining the country, resigned not his situation until 1522, when he was succeeded by his son, the Earl of Surrey. The Duke of Suffolk, unjustly incensed against Wolsey for refusing to cancel his debt to the King, absented himself for some time from court, but was soon recalled to the presence of Henry, whose favour he continued to enjoy long after the more brilliant prospects of the Cardinal had been darkened by reverses. Fox, the early patron of Wolsey, quitted the court, more in sorrow at his own loss of power, than in anger towards him whose exaltation he had hastened. The advice of the Bishop to Henry, that he should beware how he allowed the servant to be greater than the master, " drew forth a reply which was amply verified in this reign—that the servants of the King should obey, and not command."

## Chapter Second.

*Preferments, Revenues and Household Establishment of Wolsey.—His sentiments towards Francis the First.—Wolsey as a Judge,—as an administrator of the Church Laws.—Mission of Wolsey to France, and its consequences.* [1516 to 1521.]

Wolsey was now Cardinal de Santa Cecilia, Archbishop of York, and Chancellor of England. His aspiring mind was not satisfied even with these distinctions; and resolving to obtain the supremacy in ecclesiastical affairs relating to this country, he sought, and procured a bull, investing him with legatine authority. This commission procured to the Cardinal a vast accession both of wealth and influence; and it appeared scarcely possible that he could exercise the authority thus intrusted to him, in the three great situations which he filled, without peril to himself, and encroachment upon the dignity of the King.

1516.

To support the style suitable to his rank in the church and the state, the revenues of Wolsey were necessarily the object of his solicitude; and it is melancholy to see that in a mind naturally liberal, ambition gave birth to avarice, and avarice engendered laxity of principle. This powerful statesman, who should have been incorruptible, scrupled not to receive from Charles the Fifth, Emperor of Germany, the annual bribe of three thousand pounds Flemish; and from Francis the First, twelve thousand livres, also paid yearly, in order to secure the interest of the Cardinal in behalf of those Princes.* Nor did he blush to stipulate with the secretary of the Duke of Milan, that, upon the promise of an inviolable peace between Henry the Eighth and that Potentate, an annuity of ten thousand ducats should be transmitted to enrich the coffers of Wolsey, during the life of the Duke.† In addition to these acts of baseness, it is recorded, to his further disgrace, that he was accessible to the influence of presents, in the exercise of his legatine office; and that he degraded himself by extortions to a considerable extent, in that capacity. Augmented by these resources, the income which Wolsey enjoyed would appear ample, even if estimated according to the value of money in the present day, when a pound is equivalent to a crown only of the coin of Henry the Eighth. But Wolsey had still other means of obtaining wealth. Besides the scandalous emoluments already recited, he derived profits of a less reprehensible nature, from the bishoprics of Bath, Worcester, and Hereford, which he held in farm for the foreign dignitaries to whom these sees belonged, and who preferred receiving from them a regular sum to an uncertain and precarious collection of their full revenues by agents.‡ This injurious system had been too long practised to reflect upon the conduct of Wolsey in lending his countenance to it; it had even been encouraged by Henry the Seventh, who, with great professions for the weal of the church, had chosen thus to risk its best interests, by rewarding foreigners, sent on legations or other business, with benefices upon which they could not reside; a mode of payment more consonant to the inclina-

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* Anderson's History of Commerce, vol. i. p. 30.

† See, in Rymer's Fœdera, vol. xii. p. 525, a promissory obligation to this effect, from the secretary of the Duke of Milan.

‡ See Fiddes's Life of Wolsey, p. 107.

tions of that wary king, than pecuniary remuneration for the services rendered to him. Beside the sums reaped from this commercial scheme of managing ecclesiastical affairs, Wolsey derived the privileges of patronage in each diocese; for the disposal of the livings in the presentation of the foreign bishops was included in his bargain: and, with his usual dexterity in turning all things to the best account, it may be conjectured that this authority was not unproductive of emolument, as well as power. To the funds arising from these sources were added those proceeding from the rich abbey of Saint Albans, held by him in commendam, although he did not enter upon its temporalities until 1521. It is true that when Tournay was afterwards restored to the French, he was compelled of course to resign the bishopric of that city; but he received twelve thousand livres yearly by way of compensation: and the bishopric of Durham, which he also held, but resigned into the King's hands upon the death of Bishop Fox, he relinquished in like manner for the see of Winchester, to which he was immediately advanced.*

That Wolsey, possessing such opportunities of accumulating money, should not have provided for a reverse of fortune but too probable in his case, by transmitting sums of money to some foreign agent, appears to indicate a remarkable want of foresight, or a strangely overweening confidence in a man otherwise so gifted. He seems, indeed, while he collected rapaciously, to have spent lavishly; and there are few narratives which present a more curious detail of combined luxury and pomp, than the account given by Cavendish of the household arrangements, the dress, and the retinue of Wolsey.

In compliance with the practice usually adopted by the nobility of the times, Wolsey formed his domestic establishment upon the model of the royal household. The vast number of individuals residing under his roof were ranged in three classes; a distinction esteemed necessary when the attendants varied in their rank and origin from the son of an Earl, to that of a peasant. Accordingly, three tables were spread daily in the great hall, in which the ample, but rude and unsocial repasts of our ancestors were uniformly served: and where the invidious and indelicate interposition of the salt-cellar to divide the superior from the inferior classes, was as widely at variance with our present improved notions of right, as with all the feelings of propriety which forbid the appearance of any distinction whatever between guests who are admitted to the same board. It is probable that, in Wolsey's household, the various ranks and offices of each individual were more systematically defined, than among the numerous, but sometimes ill-arranged domestics of the nobles of that day. Three tables were placed daily in the hall of the Cardinal, each being superintended by an officer, suitable in station to those over whom he presided. At the head of the first table sat a priest or dean, who fulfilled the capacity of steward, and whose company at the table consisted of the first class of domestics; while the treasurer, who was always a knight, and the comptroller, an esquire, each of whom bore white staves of office, took their seats at the head of the second and third tables. The lower class of domestics, who performed the menial offices, took their meals in the hall kitchen, under the direction of two clerks, besides a clerk of the kitchen, a surveyor of the dresser, and other agents in this well-arranged system of luxury. But in addition to the tables thus enumerated, as daily spread for the accommodation of the household, there were others prepared in separate apartments. At one board sat a company of young lords, who were placed under the roof of the Cardinal for the purpose of polite education, and who paid for their board and tuition. These youths were entrusted to the care and guidance of an instructor of the wards, whose duty it was to initiate his pupils in the forms of graceful behaviour, and in the mode of exhibiting a proper deference toward superiors. Each of these noblemen was allowed several servants; the Earl of Derby, who, as well as Lord Henry Percy, the son of the Earl of Northumberland, was an inmate of Wolsey's, had five, but most of the young lords were contented with two, attendants. The gentlemen ushers, among whom was Cavendish, the biographer of Wolsey, were permitted to sit at the "mess of lords:" but another table was prepared for the chamberlains and gentlemen waiters, although these were men sprung chiefly from good families. Of Wolsey's individual repast, nothing is said by Ca-

* See Lord Herbert, p. 78—Cavendish, p. 95.

vendish; but it is probable that he sat with the young lords.

The kitchen of the Cardinal was under the direction of a master cook, who went about daily, in garments of damask satin, or of velvet, and wore a chain of gold round his neck. To execute the commands of this distinguished and important personage, were two grooms, six labourers, and as many children, who probably assisted in turning the spit; a laborious, but indispensable occupation, both degrading and unwholesome, the necessity of which has been happily superseded by well-known machines of modern invention. The allied offices of larder, scalding-house, wafery, bake-house, scullery, buttery, pantry, ewery, chaundery, cellar, and garden, together with the laundry, and wardrobe of beds, had each distinct grooms, yeomen, and pages, varying in number according to the occupation required in each province. To this list must be added two tall yeomen and two grooms, who acted as porters; a yeoman of the barge; a master of the horse, a clerk and yeoman of the stable; a saddler, a farrier, a yeoman of the chariot, a sumpter-man, a yeoman of the stirrup; a muleteer, and sixteen grooms of the stable, each of them keeping four great geldings.

A yet more numerous and more expensive order of inmates, however, deserve notice. Much of the expenditure of a nobleman, or dignitary of the church, in those days, went to support a numerous and luxurious body of chaplains, who were liberally paid, sumptuously maintained, and, when officiating in their sacred office, magnificently attired. There were in the service of Wolsey, a dean, who was always a great divine; a sub-dean, a repeater of the quire, a gospeller, or reader of the gospel, a pisteller or reader of the epistle, and twelve singing priests. These clerks all found means to enrich themselves in the household of their opulent and lavish patron; and were proved at the exposure of his affairs, which eventually took place, to be the richest of his dependants. To assist in the performance of the fascinating, but unsatisfactory service which the church then enjoined, these clergymen had twelve singing children, and sixteen adult choristers, with a master to instruct the children, and a servant to attend upon them; and occasionally there came, says Cavendish, "divers retainers of cunning singing men," to swell the full strains which were sung at the principal feasts. Our simpler and more rational notions of the services acceptable to the Most High have banished, perhaps with too unsparing a hand, the luxury of hearing fine devotional music in our churches; but it is agreeable to reflect on the improvement of taste which has abolished the gorgeous dresses, approved even by the cultivated and fastidious taste of Wolsey. The furniture of his chapel, the jewels, ornaments, and garments placed there for the use of the priests, the crosses, candlesticks, and other implements of devotional splendour, were more than ordinarily costly and abundant; and Cavendish enumerates forty-four copes of the richest materials to have been occasionally displayed by the chaplains of the Cardinal, when in solemn procession. Beside this clerical establishment, Wolsey had an almoner, whose usual office in such households was to attend upon the lord and master at dinner, in conjunction with the carver, the cup-bearer, the gentlemen yeomen, and gentlemen waiters, and, in some families, to have the residue of the repast at which they had assisted.* This class of attendants amounted, in the household of Wolsey, to forty-six in number, and with the chamberlain, vice-chamberlain, gentlemen ushers, yeomen ushers, grooms of the chamber, and yeomen of the chamber, may be considered as the peculiar and personal servants of the Cardinal. These formed, alltogether, a body of one hundred and forty-three persons.

The secretaries, clerks of the signet, and counsellors of Wolsey, of whom he had six, were always persons of information and character. Sir Thomas More, Gardiner, bishop of Winchester, and Thomas Cromwell, afterwards prime minister, each at some period of their lives held one or other of those offices in the establishment of Wolsey; a mutual advantage being afforded to master and dependant by the free intercourse of powerful, though dissimilar minds.

The manner in which it was the daily custom of this proud prelate to repair to the exercise of his public duties, was suitable to his domestic splendour. In the morning, after being apprized that a number of peers and of commoners awaited his appearance, Wolsey came forth from his chamber, into his state

* See Northumberland Household Book, pref. 417.

apartments, in his cardinal's dress of crimson or scarlet satin or damask, the richest that could be procured, and wearing upon his head a "pillion" or cushion, surmounted with a noble, or elevation of black velvet, attached to the cushion. About his neck he wore a tippet of fine sables; nor was the magnificence of his attire confined to the more conspicuous parts; even his shoes were the subjects of wonder and of ridicule to a satirical contemporary of the cardinal, in a supposed dialogue between two priests' servants.

"Rede me, and be not wrothe,
"For I say no thyng but trothe;
"He hath a payre of costly shewes
"Which seldom touche any grounde,
"They are so goodly and curious,
"Are of gold and stones precious,
"Costing many a thousand pounds.
"*Wat.* Who did for the shewes paye?
"*Jeff.* Truly many a rich Abbaye,
"To be eased of his visitacion."*

Thus attired, and holding to his nose the peel of an orange filled with sponge dipped in "vinegar, and other confections against the pestilent air,"† Wolsey walked with great pomp to the outer door of his mansion, the great seal of England being carried before him, and after that, the cardinal's hat borne by some nobleman, or gentleman, bareheaded. And thus passing on, preceded also by his two great crosses of silver, and followed by two pillars, and a large silver mace, gilt, the Cardinal, amidst the cries of his gentlemen ushers, "On, on, my lords and masters," amidst the envy of some beholders, and the admiration of others, bent his course to the court of chancery, riding upon a mule splendidly caparisoned, and attended by his pillars, his crosses, his pole-axes, and running footmen. While condemning as frivolous and pompous this ostentatious array, the benevolent mind reverts with pleasure to one circumstance, which presents the character of Wolsey in a more favourable aspect. It was not until after he had paid his early and private tribute of devotion at the shrine of "Him who doth dispose and govern the hearts of princes," that Wolsey resorted to the business of that world, the enjoyments and even the cares of which render such a preparatory service but too requisite. To attend the performance of the ordinary masses, merely, might have been deemed by the Cardinal a customary act of decorum, with which no head of a household could, with propriety, dispense. But Wolsey, not satisfied with this observance only, retired within his closet, and alone with his chaplain, a man of learning, and of veracity, he went through his daily service; nor did he, according to the testimony of that person, retire to bed, however he might be oppressed with fatigue of body, or anxiety of mind, with even one collect omitted, in his customary and prescribed devotions.*

It was both the interest and the inclination of the Cardinal to render the banquets which he gave to the king more agreeable to Henry, and more dazzling to the courtiers, than the entertainments given by any other person of rank. The king had a childish delight in a surprise, which then constituted the chief spirit of a courtly assembly: accordingly, it was his whim to arrive suddenly at the episcopal palace of Whitehall in a mask, with a small group of companions, dressed to represent shepherds, but with garments made of fine cloth of gold, and their hair and beards composed of silver and gold wire.

The Cardinal, who was seated under his cloth of estate, at a sumptuous banquet, graced by the presence of mingled gentlemen and gentlewomen, was warned of the approach of the royal shepherd by the discharge of "chambers," or small cannon, so called from their being little more than chambers for powder, resting upon no carriages, and adapted only for festive occasions.† To play disguised at a game of dice, called num-chance; to dance with the ladies assembled on the occasion; to challenge the guesses of the Cardinal as to which of the newly arrived band was the king, and to enjoy his mistake in fixing on Sir Edward Nevill, a comely and portly knight, for his royal master, constituted the chief diversion of the night, the business of which was eating and carousing. Unsuitable indeed were such amusements to the situation of Wolsey as a dignitary of the church, to his occupations as a minister and as a judge, and to his character as a man; and perhaps they contributed, in reality,

* See Dialogue between Watkins and Jeffrey, two Priests' Servants, by William Roy; the first person, according to Anthony Wood, who reported Wolsey to be the son of a butcher. Wood's Athenæ Oxonienses, vol. ii., p. 734.

† Cavendish, p. 105.

* Cavendish. p. 105.

† See Cavendish. Note by Singer, p. 113.

but little to the influence which he long held over the mind of his sovereign.

The position of foreign affairs, during the early part of the reign of Henry the Eighth, assisted in augmenting the power which Wolsey already possessed. Peace had indeed been concluded with Louis the Twelfth, and it was cemented by the sacrifice of Mary, the young and beautiful sister of Henry, at the altar of policy, where she was united to the king of France, a man nearly three times her age, with the consolation only of being as conspicuous for her rank, as she had before been for her personal charms. The death of Louis had dissolved this unnatural bond; but while it rendered the continuance of the treaty uncertain, it imparted happiness to the queen widow, who almost immediately bestowed her hand on Charles Brandon, Duke of Suffolk. Henry was at first indignant at the choice which his sister had made, having probably cherished the intention of advancing the interests of his kingdom by seeking another alliance between some foreign potentate and his sister.

The part which Wolsey took in this affair was conciliatory, and it may have been disinterested. He warned the young dowager against a hasty marriage,* immediately after the death of her royal consort: but, when the consequence of an ardent and mutual attachment became irrevocable, and was avowed, he endeavoured to reconcile the mind of the king to an event which could not be recalled.† Henry, who began to perceive that it would be more for the honour of his sister to return to her country with her rich dowry, than to bestow it upon some foreign nobleman, or petty prince, was consoled, also, by the partiality which he entertained for Brandon, one of the earliest and latest of his friends.

The peace which had been concluded between England and France, before the death of Louis the Twelfth, was not of long continuance after the accession of Francis the First. That monarch, brave, generous, and accomplished, was by no means the first aggressor in the hostilities with which he was for some time menaced by Henry. Disposed both by policy and inclination to maintain a close alliance with England, he had, nevertheless, the ill-luck to incur the resentment of Wolsey, who too frequently allowed his private interests to affect the great affairs of his country. The cause which has been assigned for the animosity expressed by Wolsey towards the French king, related to the bishopric of Tournay, which, while it yielded an ample revenue to the Cardinal, had occasioned him considerable trouble and anxiety, from the unwillingness of Guillart, the deposed bishop, to resign his spiritual jurisdiction. Strengthened by a bull from the pope, Guillart had acquired a number of partisans both within the city and elsewhere; and Wolsey, alarmed for the consequences of this success, solicited Francis to confer another bishopric upon Guillart, in order to divert him from prosecuting his designs upon Tournay. Francis either declined, or delayed to comply with this request; and the indifference thus evinced to his interests was not forgiven by the Cardinal, until he had been conciliated by the flattering terms of "Pater" and "Dominus" addressed to him by Francis, and more effectually appeased by the powerful agency of gifts and promises.* 1518.

While a sentiment of displeasure towards Francis prevailed in the breast of the Cardinal, the measures pursued by the English government tended to an alliance with Maximilian, Emperor of Germany, with Pope Leo the Tenth, and with the wily Ferdinand of Spain. The death of Ferdinand, the discovery of the artful and plausible character of the emperor, and the skilful negociations of Francis, produced a manifest change in the politics of the English court. Wolsey was employed as the mediator between Francis and Henry, and he displayed so much address in this important matter, that Henry, in the exultation of his heart, declared "that Wolsey would govern both him and the King of France." Ambassadors were soon afterwards dispatched from France to London, and a treaty was concluded, containing a clause relative to the restitution of Tournay, a point which Henry, prompted by the representations of his minister, was induced to concede.—Wolsey had long been weary of the trouble and insecurity of his foreign see, and the compensation offered to him, was a desirable equivalent for sums which were collected and transmitted with dif-

* See Ellis's Original Letters, vol. i, p. 118.

† Herbert, p. 55.

* Herbert, p. 74.

ficulty. The other Englishmen, officially concerned in the garrison of Tournay, were also remunerated for the loss of their posts by the distribution amongst them of money furnished by the French king.

While thus engaged in foreign negotiations, Wolsey exercised,
1518. with diligence and impartiality, his authority as chancellor, an office in which he is said to "have spared neither high nor low, but to have judged every estate according to their merits and deserts." *

The first measures of the Cardinal, in this capacity, were unpopular, and in some instances frivolous and injudicious. Considerable importance was at this time attached to the subject of apparel, and by a recent act, the dress of the laity of every condition had been regulated, forfeitures being assigned for the neglect of its observances. To enforce the new statute, Wolsey sent commissioners into different counties, with charges also to regulate the wages of labourers, their hours of meals, and of rest, settled, in these despotic times, by act of parliament. These agents exceeding probably the injunctions given them, a degree of tyranny was exercised which occasioned the loudest discontent. At Rochester, the just indignation of the populace broke forth on seeing a man pilloried for no greater offence than that of wearing a shirt made of a particular kind of cloth called "ryven." It is difficult to comprehend why so much stress was placed upon a mere distinction in the texture of habiliments, unless it may have originated in a desire for the protection and benefit of some particular manufacture, at that time in need of encouragement. Wolsey was not, it appears, at all times superior to the indulgence of petty irritation, and he even committed his dignity in the dispute, by taking the law into his own hands. Observing, one day, an elderly man in an old crimson jacket, adorned with various brooches, the Cardinal, with his own hands, took from him a dress which the offender was probably not entitled by his rank to wear, but which compassion and decorum should have spared to the aged and defenceless delinquent.†

This act of severity excited much animadversion upon the conduct of Wolsey; and a similar degree of unpopularity attended the necessary duty of calling to account all those persons in whose dealings either fraud or carelessness was detected, touching the money transactions of the late war. The most salutary regulations were also made respecting perjury, a crime of alarming frequency in the preceding reigns, when evidence in the various courts of justice might be openly bought and sold. Wolsey visited this offence with severity proportioned to the heinousness of an act, which, in the words of Lord Herbert, comprises murder, theft, and detraction: it was, therefore, greatly diminished. During the legislation of this vigorous but unpopular minister, who sedulously endeavoured to inculcate the necessity of a regular administration of the law, courts were erected in order to protect the poor from the oppressions of the rich, who, in those days, thought the world made only for them. These tribunals were at first thronged, but soon fell into disrepute from the delays and improper decisions to which the suitors found themselves liable; and the courts of common law were eventually preferred.* The intention of Wolsey, in thus providing for the benefit of the lower classes, was, however, laudable; and while he exercised a due authority over them, he endeavoured, on various occasions, to raise them to a state of greater independence, and of more importance in the state. By his vigilance and rigid administration of justice, the highways were in a great measure freed from robbers, by whom, in the absence of a regular police, they had been infested to an alarming extent. Acts of violence were visited with speedy and impartial retribution, and, according to the celebrated Erasmus, who was well acquainted with this country,—"it became as free of harmful men, as it was of poison and noxious beasts."† Lawsuits, which had long wearied the suitors, from the vexatious indecision of preceding chancellors, were now equitably adjusted. The decisions of Wolsey as a judge were allowed to be generally impartial, and his estimation of the evidence before him judicious. "It was strange," observes a chronicler of this period, "to see the Cardinal (a man not skilled in the laws) sit in the seat of judgment and pronounce the law, being aided at first by such as (according to

* Cavendish, p. 107. † Hall's Chronicles.

* Herbert, p. 67.
† Strype's Ecclesiastic Memorials, vol. i., p. 193.

ancient custom) did sit as associate with him; but he would not stick to determine sundry causes, neither rightly decided nor adjudged by order of law."* He would even reprove sharply those judges who had allowed themselves to be imposed upon by false evidence, and who had not well considered the testimony of both parties. A degree of celerity in the dispatch of legal business was ensured by Wolsey, deserving of gratitude, both from his contemporaries and from posterity. Upon the representation of the Cardinal, the king granted a commission to the master of the rolls, the chief baron of the exchequer, and four of eighteen persons specified, to hear and determine causes in chancery when the chancellor should happen to be engaged in state affairs. This privilege has continued, with some variations, until the present day. Disgusted by the ignorance of the lawyers, and even of the judges, he planned an institution in the metropolis, by which opportunities for studying that science should be afforded to the diligent; but this project, like several beneficent and liberal designs of the Cardinal, was never realized. The model of the building was long treasured in the palace of Greenwich, after the death of Wolsey, as a fine specimen of architectural taste.†

During this period of our history the Chancellor had the sole power of bringing Bills into Parliament, which he exercised by means of committees of his own appointment. An examination therefore of the Statutes passed during the term that Wolsey held the Seals, would show the principles of government on which he acted, and would throw additional light on his general character. Two-thirds of them would be found to be enacted for the protection of trade and manufactures, all of which are now either repealed or have fallen into disuse. These acts, by the number of their minute and painful restrictions, sometimes on the manufacturer and importer, and sometimes on the consumer, evince at once the laudable anxiety of the minister for the welfare of the industrious classes, and his profound ignorance of the great truth, that commerce is always fettered and never served by the officiousness of legal interference. The excellences and defects of Wolsey's legal administration (so far as it was honest) seem to spring from the same source—the industry with which he carried legislation into a rigid and minute detail. His amendments in the various processes of the law,—his reform of church discipline, especially in his attack on pluralities,—are favourable instances, and ought not to be forgotten in the balance of his merits. Indeed, even with respect to his interference with the freedom of trade, he ought, perhaps, rather to be praised for having so distinctly seen the value of the object, than censured for having mistaken, in common with men of later days and better lights, the means by which the object was to be obtained.

In his administration of the affairs of the church, the conduct of Wolsey was far less exemplary than in his legislative functions; and were it not for the liberal views which he afterwards manifested in the promulgation of learning among the clergy, he would have merited from that body the severest reprobation. A new dignity was now added to the accumulated honours which Wolsey had gained. Leo the Tenth, desirous of establishing a league among all the princes of Christendom against the Turks, sent Cardinal Campeggio into England for the purpose of entering into a negociation with Henry to that effect; at the same time the legate was empowered to collect a tithe from the English clergy, and to visit and reform the monastic institutions in this country. In order to conciliate the British monarch, Leo not only enjoined Campeggio to cultivate assiduously the friendship of Wolsey, but consented to invest the Cardinal of York with the legatine authority also; and Campeggio was detained at Paris, until a commission to that effect should arrive. This delay was suggested by the vanity of Wolsey, who both objected to admit any one invested with greater ecclesiastical power than himself; and who desired that Campeggio should be supplied with the means of supporting the dignity of his high office, which derived, in the eyes of Wolsey, additional importance, from his being joined with Campeggio as a colleague. With this design, a quantity of scarlet cloth was dispatched to Calais to supply the retinue of Campeggio with new attire, of which it stood in great need. This precaution having been adopted, and the bull of the pope received by Campeggio, that legate was permitted to

1518.

* Holinshed's Chronicles, p. 615.
† Galt's Life of Wolsey, p. 209.

cross to Dover, and to enter London with the accustomed parade; yet Wolsey, not satisfied with the reported appearance of Campeggio and his train, sent twelve mules laden with baggage to increase the procession of his colleague. These chests were supposed to contain rich articles of jewellery, plate, and garments, of which the Italian legate was understood to possess a superabundant portion: but unhappily for the credit of Campeggio, one of the mules fell, and the coffer which it carried being burst open by the accident, old habiliments, and pieces of broken bread, or meat, put into the chest as ballast, were exposed to the spectators, too well disposed to sneer at the mock grandeur of the procession.*

Campeggio having paid his tribute of respect to the king, in company with Wolsey, the business of the legation commenced. No success attended the demand made upon the clergy, who refused to pay the tithe; and the visitation of the monasteries remained the sole object of the commission. On this subject it is probable that Wolsey had long formed his opinion, and that it was possibly his desire to effect his great designs without the fear of dissent, or interruption from a colleague. He dispatched Doctor John Clarke, therefore, to Rome, with a petition that the legatine power in England might be vested solely in himself, and that Campeggio might be recalled. The reasons assigned for this request related to the immoralities and ignorance of the clergy, which were enumerated by Wolsey in strong, and probably just terms. Doctor Clarke, acting both at the instigation of Wolsey, and by the command of Henry, proved a successful negotiator. He obtained a bull from Leo, constituting Wolsey legate *a latere*, with power to visit and to reform the monasteries and the clergy of England; and with the unusual and hazardous privilege of dispensing with all church laws for the term of one year after the date of the bull.†

June 10, 1519. This extension of authority gave great offence to the bishops, whose powers it abridged; and was displeasing to the nation at large, who having already beheld Wolsey and Campeggio endowed with the privilege of granting remission for sins, after they had celebrated mass, deemed that the overweening greatness of Wolsey was dangerous to the people, and injurious to the honour of the king.

Invested with authority which was likely to have an intoxicating influence over his own mind, and which was sure to excite the jealousy of others, Wolsey possessed not prudence, nor, indeed, integrity sufficient to defend him from the snares which sudden prosperity spreads for wisdom and virtue. His first act, as a legate, was to erect a court, in which a kind of inquisitorial jurisdiction was assumed over the clergy. Irregularities and offences, which had either escaped the cognizance of the law, or were not within its prescribed limits, were the objects of inquiry and of punishment at the new tribunal which Wolsey instituted. If the injustice and extortion imputed to him in the exercise of these functions be proved, the conduct of Wolsey in this department is more than ordinarily reprehensible, as the worst feature of the corruption which he had undertaken to abolish. The chief evidence against him in this respect is derived from the history of Polydore Vergil, a foreigner naturalized in England, whom Wolsey had rendered his enemy by committing him, for some offence, to prison. According to this writer, the legatine court was a scene of oppression and exaction of the most scandalous kind. All ecclesiastical persons, suspected of any misdemeanour, were summoned before the president, and were obliged, in many instances, to compromise, by large sums of money, charges from which they could not directly clear themselves. Executors of wills were called to severe account; livings in the gift of the nobility were given by Wolsey to his dependents; and the registration and proof of wills, hitherto the sources of profit to some of the dignitaries of the church, were now monopolized by the Cardinal.* John Aleyn, a priest, who was the person appointed by Wolsey to preside over the court, was, according to Polydore Vergil, a man of abandoned character, with whom all honest individuals dreaded to have any concern. These alleged abuses, which were repeated as accusations in the articles afterwards exhibited against Wolsey, in all probability existed to a certain extent.

The sense of justice which Wolsey manifested in all his other legislative functions, is at variance with the out-

* Hall's Chronicles, p. 593. † Herbert, p. 79.

* Henry's History of England, vol. xii. p. 11.

rageous iniquities which he is affirmed to have countenanced; while, at the same time, his undoubted eagerness for gain may have acted, in some cases, as a counterpoise to the valuable and upright parts of his character. Wolsey was too much feared and hated to do evil without detection. Warham, archbishop of Canterbury, the constant, but temperate opponent of Wolsey's arrogance, informed the King of the reports which taxed his favourite with injustice and extortion. "Father," replied Henry, "no man is so blind as in his own house; I pray you, go to Wolsey, and tell him, if any thing be amiss, that he amend it." This command was obeyed by Warham, who disliked the innovations, as much as the insolence of his rival. The admonition of the primate produced, however, no other effect than that of increasing the hatred of Wolsey towards him; but the information which Warham had imparted to the king was not wholly inefficacious. It opened the eyes of the King to the fallibility of his minister; and some time afterwards, when Aleyn was accused of illegal practices, Wolsey received a severe rebuke from the king, for tolerating the conduct which he ought to have condemned. From this incident, according to the confident opinion of some historians of that period, the decline of Wolsey may be dated.*

While these circumstances were gradually undermining his influence at home, it remained, to all outward appearance, undiminished; and, at foreign courts, his will was the pivot upon which all important operations moved. One leading principle, governing all the actions of the Cardinal, may be observed, from about this period, until all hope of attaining the object of his wishes was eventually precluded. He had been already exalted to a station, eminent beyond that which any former subject of a British monarch ever enjoyed; yet, like Alexander, he sighed for a new sphere over which he might extend his dominion; and the ambitious and restless ecclesiastic now directed his hopes to the papal crown. At what period of his life this desire was first kindled in the breast of the Cardinal, must be a matter of conjecture: but, perhaps, like many other aspiring men, the earliest yearnings of his soul for distinction were encouraged by a remote and apparently futile hope of attaining the highest point to which persons of his class and profession could arrive.

The principal influence among the conclave of cardinals, who held the papal election in their hands, was divided between France and Spain; and Wolsey was for some time undecided to which of these continental powers he should devote himself in expectation of assistance. Francis the First possessed fourteen votes in the conclave; he offered his interest to the Cardinal, and seconded his promises by presents and pensions. For some time Wolsey was disposed to adhere to the King of France, but wavered when he saw the young King of Spain raised to the imperial throne. The wisdom and energy already displayed by the young emperor, and the extent of his dominions, ensured to him a degree of importance in the affairs of Europe, which, as Wolsey easily foresaw, would eventually preponderate. The eagerness which Charles displayed to conciliate the British minister, his flattering epithets of "most dear friend," and his pension of three thousand livres, decided the choice of Wolsey, and he may from henceforth be regarded for some years as the secret and powerful ally of the Spanish court. His own mind being determined, Wolsey was not tardy in turning his master to the side of the young emperor; but Henry was constrained for some time to dissemble his intentions.

It had been agreed, in the treaty with France, during the preceding year, that an interview between the two kings should take place at an early period, within the English territory in France. Honour, policy, and inclination forbade the breach of this engagement on the part of Henry; nor was Wolsey reluctant to display to admiring France his greatness, as the proudest and most powerful subject in the train of his sovereign. The celebrated meeting at the field of Ardres, merits, from its novelty in the annals of Europe, and from its magnificence, the minute description which it obtained in some of our English chronicles, and in the lively memoires of the Marquis de Fleuranges, one of the nobles who accompanied Francis, and who was commanded by that monarch to commemorate the event. It was the last semblance of chivalry, which expired with Henry the Eighth, the festive diversions in the reign of Elizabeth being but the shadow of

* Herbert, p. 81.

knightly prowess. It was the most splendid incident in the life of Henry, and Wolsey shared its glories and its luxuries. Precluded by his sacred office from a participation in those exercises which delighted the young and gallant monarchs, Wolsey, however, appeared in costly and pompous array, as was his usage on all festive and ceremonious occasions. It was his courtesy which directed the ornaments, his judgment which prescribed the regulations of the meeting. As a political affair, the personal communication between Francis and Henry was followed by no important effects. Their union was rather prevented than cemented by the event. The utmost courtesy and deference were, it is true, displayed on either part, both by the princes and their attendant nobles. Yet, in the midst of the most peaceful interchange of compliments and presents, the discerning spectator might have detected the secret aversion of Wolsey from an alliance with France; the ill-disguised distrust of the courtiers and people assembled on both sides; the irresolution of Henry, and the apprehension of Francis that his hold was insecure over the favour of his apparent friend. The scene must have been curious and interesting; unhappily it was soon to be followed by one of a solemn and afflicting character.

On quitting Ardres, Henry repaired almost immediately to Gravelines, where he was joined by the emperor, with whom an understanding had been already commenced in a visit which Charles had recently made to the King of England. Neither Henry nor Wolsey considered it any derogation from their honours to encourage the alliance of this rival of the French king, at the very time that every manifestation of friendship had been displayed towards Francis. The subtle policy of Wolsey was visited with retribution, and he sunk eventually into snares prepared by his own insincerity and vacillation. Engaged as he was with diplomatic manœuvres, his mind was also disturbed by the evident hatred and jealousy of the English nobles. Whilst the higher classes of the community outwardly paid homage to his rank and power, they secretly railed at the haughtiness, and recalled with contemptuous bitterness the lowly origin of the Cardinal. Among those highly born individuals, who, in those days of comparative darkness and ignorance, regarded no distinctions as worthy of consideration, except the accidental circumstance of ancient and noble descent, none looked with more indignant disdain upon Wolsey, than Stafford, duke of Buckingham. Allied to the family of Plantagenet both by the male and female line, the proud and aspiring character of the duke had even rendered the suspicion probable, that he was not without hopes of one day ascending the throne, in case of the king's death without issue: if Buckingham ever cherished treasonable designs, the birth of the Princess Mary must have dispelled all confident expectations of success. Previous to that event, he had, unhappily, been induced to hold conferences with those who first tempted him to the premeditation of guilt, and then betrayed his secret. Unconscious of the impending danger, Buckingham accompanied Henry to the field of Ardres, and shone there, one of the most splendid of the English courtiers, who, on that occasion, were said to have far surpassed the French in magnificence. Perhaps the very display which was in part intended to do him honour, exasperated the jealous frenzy of Henry. Shortly after the return of the king and Wolsey from France, Buckingham felt the effects of the gathering storm. He was apprehended, arraigned for high treason, tried, and condemned. His sentence, accelerated by the evidence of his dependents, produced universal regret among his fellow-subjects, and lamentation abroad.

Like all other passing events, the execution of Buckingham was imputed to the Cardinal. Even the emperor is declared to have said that the "butcher's dog had slain the finest buck in England." At home, it was supposed that a trifling incident had occasioned that bitter enmity in Wolsey towards the duke, to which his cruel fate was attributed. It was the custom for the highest of the nobility to hold the sacred water, present the ewer, and perform other offices of respect, at mass, when Wolsey assisted at the service. The more obsequious or more cautious courtiers submitted to the necessity which there appeared to be for these acts of humiliation, knowing and dreading the consequences of a refusal. Buckingham, however, inwardly chafed at the constrained semblance of reverence and even observing merely that Wolsey had the presumption, to dip his hands in an ewer of water which the duke handed to the king, he could not

brook the reflection that he had been involuntarily made to perform a service to a priest. Losing all self-command, he hastily and contemptuously poured the contents of the vessel upon the feet of the Cardinal. For this affront he swore that he would have his revenge, by sitting on the duke's skirts; a figure of speech more intelligible in the days of long trains than in the present time. Wolsey was, however, disappointed by Buckingham's appearing at court on the following day without any skirts to his coat, assigning as a reason for this new fashion that he was resolved to baffle the malicious designs of the Cardinal. For this childish and ridiculous warfare, if Wolsey be justly considered as the originator of Buckingham's ruin, the duke paid dearly. It is certain that, had Wolsey desired to rescue this proud noble from a degrading death, he possessed the power of saving him, for Henry, at this time, would have granted the privilege of mercy to his minister. It is perhaps unfair, however, to consider the conduct of Wolsey on this occasion as wholly dictated by the meanness of revenge. He may have deemed it a necessary act of caution to check, by the death of Buckingham, those aspiring views in the nobles allied to the crown, by which the peace and security of the country might be troubled.

There is reason also to believe that Buckingham was not entirely guiltless of the designs imputed to him; and the example of his father, who had once meditated asserting a claim to the English crown, was not obliterated from the recollection of the public. The most discreditable feature in the proceedings against him was the care taken by Wolsey to procure the absence of those friends and relatives of the unhappy duke, whose intercession might have averted his fate. Twenty-six peers only sat on the trial; and the sentence was pronounced with tears by the Duke of Norfolk, too subservient a courtier to decline this sad office, although the personal friend of the prisoner. Some indications of mercy were manifested on the part of the king; and while his obnoxious measures are imputed to the influence of Wolsey, it is but fair to ascribe to the same source those which betokened a milder spirit. The decree by which the punishment of hanging was adjudged to Buckingham, was changed into the sentence of decapitation, and part of the forfeited estates were restored to the eldest son. Popular feeling was, however, in a state of unabated irritation against Wolsey, for some time after the death of Buckingham. The galling remark, that a "butcher's son must naturally delight in shedding blood," and other effusions of public resentment, were probably neither unfelt nor unobserved by the Cardinal; and he found, perhaps, relief from some annoyance in the mission which he was at this time induced to undertake, with the avowed object of composing the differ- 1521.
ences now verging towards hostility, between the emperor and the king of France.

The actual end to which the exertions of Wolsey were directed in the negotiation was to form a confederacy with Charles against Francis on the part of England; and, on his own account, to obtain a promise from the emperor, in case of the decease of the reigning Pontiff, to aid his long-cherished wishes on that point. Charles readily, but without sincerity, accorded the favour requested; secretly resolving, as his subsequent actions proved, to suit his own convenience in the result. A treaty was concluded between the pope, the emperor, and the king of England, to the exclusion of Francis, against whom hostilities were meditated.

## Chapter Third.

*The part taken by Wolsey in the Controversy between Henry the Eighth and Luther.—His desire for the Revival of Learning.—His Schemes with respect to the Monastic Institutions.—Erection of the Cardinal's College at Oxford.—His Regulation of the Royal Households.—Embassy of the Cardinal to France.—His decline in the favour of Henry.—The Great Seal taken from Wolsey.—His Humiliation,—Impeachment,—Illness,—Death,—Character,—Burial.*

It is necessary to take a cursory view of the life of Wolsey at this period, in order to arrive at 1521.
those benevolent designs, and at the great though imperfect achievements which constitute the real glory of this celebrated man; and which afforded a far nobler exercise for his genius than the diplomatic intrigues in which he played a conspicuous, but an unworthy part. It is, however, to be regretted, that he was allured by the voice of ambition, while he cherished the schemes of a philanthropist: yet a more cautious

and less aspiring individual would never have projected, under existing circumstances, the reformation which he commenced; and, while the pride and ambition of Wolsey are to be reprobated by the moralist, it is to them that we owe the results of that power, which would scarcely have been the portion of Wolsey, without the agency of these passions.

It was at this æra that the famous controversy between Henry the Eighth and Luther attracted the criticisms of the learned, and the attention of all classes. Wolsey was not engaged in this affair, otherwise than as being one of the objects of the vituperation in which the great reformer occasionally indulged. Described by Luther, in one of his celebrated letters, as "a favourite, a monster, a person hated both by God and man," Wolsey might possibly find his zeal for the interests of the hierarchy increased by the invectives against himself, which were coupled with just, though vehement reprobations against the corruptions of the church. Want of leisure, and perhaps want of inclination to enter the lists with so powerful an adversary, deterred the Cardinal from hurling back the epithets bestowed upon him. Contented to leave his cause in the hands of his royal master, who defended the character of his favourite, in his reply to Luther, Wolsey took no vengeance, except in issuing a commission, commanding that the works of the reformer should be collected in each diocese, and delivered to him by the bishops. Having thus extracted the supposed poison from the people, he resolved to distribute the antidote. He ordered forty-two of the doctrines advanced by Luther to be posted upon the church-door, in every parish, that all persons might read and avoid these "damnable and pestiferous errors," as they are described in the commission, which also declares them "to have taken root as a noxious brier." This proceeding sullies the reputation of the Cardinal as a man of judgment and experience. It was natural that he should think harshly of Luther, and seriously of the mischief, which, as a zealous papist, he might believe to result from the opinions he had denounced: but when the intemperance of zeal had subsided, it might occur to Wolsey, that thus to afford matter for thought and speculation was to give the first impetus to schism. It is, however, probable, that he acted, in this instance, in conformity with the wishes of the king, who, by his edicts, his disputations, and vacillations, adopted the most effectual means that could have been devised for propagating a love of inquiry, and encouraging the desire of reform.

Wolsey soon proved that his notions concerning the real danger of the church were enlightened, and his plans for its benefit founded upon just and liberal principles. He saw that the majority of christian philosophers and scholars leaned to the side of the reformers; embraced their simple, but rigid persuasion; increased its growth by the influence of their writings, and honoured it by the purity of their lives. He beheld, on the other hand, the professors and dignitaries of the Romish church, obscured in intellect by the speculative and confused studies in which they were trained to glory, and degraded in conduct by the irregular and voluptuous courses in which they indulged.

To oppose "learning to learning," by encouraging a spirit of laudable exertion, to raise the meritorious members of the church into notice, appeared to the Cardinal to be the only mode by which the declining power of the hierarchy might be sustained. To this end he determined to restore the English universities, now drooping from the indifference of their teachers, to that rank of importance for which they were originally designed among the institutions of this country. Happily for England the services of Wolsey were ensured to her by the frustration of all his hopes of obtaining the papacy. Leo the Tenth expired, as it is said, of a fever produced by joy, upon hearing of the success which attended his army engaged in warfare with the French. Upon this vacancy, it was naturally the expectation of Wolsey to ascend the pontifical throne, through the interest of Charles the Fifth; but in this he was deceived. Charles had little inclination to throw, into the balance of power, a proportion in the scale so advantageous to England as the exaltation of its minister to the highest dignity in Europe. The emperor had also his own favourites, whom he desired to aggrandize; and Adrian of Tortosa, his former tutor, was elected pope before Doctor Pace, the emissary of Wolsey, could reach the scene of contention. This annihilation of all his hopes was, probably, in the mind of Wolsey, conclusive; and although these were not his last efforts to obtain the

papacy, it is likely that he considered this manifest declaration of the intentions of Charles to be an insuperable barrier to his wishes. His ambition may be deemed, therefore, from this time, to have centered in his country, and his schemes of public utility to have regarded her interests alone.

In surveying the condition of the church at this period, Wolsey perceived that, to destroy the corruption which infected the stem and branches of the tree, it was necessary to promote the healthy condition of the root. He regarded education as the soil in which religious knowledge might be restored to vigour. Hitherto the instruction of the young had been confined either to a few great public schools, to the monastic institutions, or to the humble exertions of parish clerks. The higher orders of the clergy received into their houses, it is true, as pupils, in some instances, the sons of noblemen or of gentlemen, on terms the most advantageous as far as private tuition was concerned; but opportunities such as these were afforded only to the sons of the great and opulent; whilst the middling classes of the people, from whom the clergy principally sprung, were wholly destitute of those incentives and those aids to learning, which, in our happier days, they eminently enjoy.

At an earlier period of his career, Wolsey had evinced his zeal for the revival of literature, and his sense of the inefficiency of those who were deputed to maintain its reputation, by an address to all the schoolmasters of England, exhorting them to introduce the classics into their plan of education.* He had afforded his patronage to the institution of St. Paul's School, by Doctor Colet, in 1509, and had devoted a particular attention to the structure and regulations of that valuable seminary, the first which was founded in England by any private individual; but the English universities demanded and received the first and most sedulous care of the Cardinal, and he viewed with regret and anxiety the diminution of honour and importance now attached to those venerable resorts of the studious and the learned.

It was apparently an accident which directed the notice of Wolsey to the degraded and impoverished condition of the colleges at Oxford. In 1518, the king, and queen Katharine, being on their progress, at Abingdon, a visit to Oxford was planned by the pious and intelligent Katharine, who desired both to offer her tribute of respect at the famous shrine of the virgin St. Frideswide, and to see the university. Wolsey, who was with the royal pair, accompanied Katharine in this excursion, and remained at Oxford after the departure of the queen. Upon this occasion he made an oration in the Convocation House, declaring it to be his intention to establish fresh lectures in the university, and to apply to the king in its behalf. The heads of the colleges then delivered their charters and liberties into the hands of the Cardinal, and Wolsey, shocked at the irregularity, confusion, and even dishonesty which an exposition of the affairs of the university displayed,* resolved to spare neither trouble nor expense in dispelling the gloom which negligence or knavery had thrown over the scene of his early studies.

Agreeably to his promises, Wolsey made an earnest and early application to the king in favour of the declining yet indispensable institutions of Oxford, and Henry was disposed to enter warmly into a course so accordant with his own reverence for philosophy and letters; but the power of granting pecuniary aid for the noble purpose of restoring the decayed colleges to their former prosperity, had passed away from the king, and the expenses of foreign wars and negotiations, and the costly maintenance of a dissipated court, had left no sums in reserve to promote the extension of knowledge. New and more abundant resources were, however, in store; and Wolsey had sufficient courage to resort to them, and address and wisdom to employ them with advantage.

The monastic system had for some time begun rapidly to decline in public estimation. Several of the most exalted and rigid of the English bishops, had viewed the corruptions which prevailed in religious houses with concern, and had preferred the endowment of colleges to the establishment of new monastic institutions. Reprobated, and in some individual instances suppressed by authority, the monasteries had hitherto possessed some degree of popularity, from the convenience which, in some respects, they afforded, and, among the benefits they produced, none were with so much reason insisted upon by their advocates,

* Strype's Ecclesiastical Memorials, vol. i., p. 193.

* Wood's History of Oxford, vol. i., p. 666.

as the facilities which they gave to the preservation of learning, and to the instruction of youth.

The condition of society was now, however, materially changed. The art of printing, which had flourished peculiarly in this country, had rendered the intellectual part of the community in a great measure independent of the laborious exertions of the monks, one of whose chief employments consisted in the transcribing of books. The foundation of several grammar schools, since the year 1503, and the increasing fame of Eton and Winchester, had superseded the instructions of the convent schools, which had hitherto attracted the greater portion of young students within the walls of their establishments.

These considerations, and others of too extensive a nature to be here detailed, may appear to have greatly facilitated the design which Wolsey now cherished of diminishing the number of the monasteries, and of turning their revenues towards objects more conducive to the public good, than the continuance of these corrupt and ill-arranged fraternities. But the task which Wolsey contemplated was fraught with difficulty, and attended with odium. For this great scheme, for the motives by which it was suggested, and for the effects which followed it, if Wolsey obtained not the suffrages of gratitude from his contemporaries, he has merited the veneration of all successive generations of his countrymen.

The extraordinary power which he at this time enjoyed, could alone have enabled him even to plan, with any rational hope of success, the dissolution of forty-one monasteries, which he effected in order to form a fund for the erection of new seminaries of learning. It was at first the intention of the Cardinal to have exerted simply his own authority as legate, in the suppression of those convents which were most notorious for irregularity and licentiousness; but from this measure he was dissuaded. Accordingly he applied to Pope Clement the Seventh, who had succeeded Adrian, for a bull, empowering him to suppress the monastery of Saint Frideswide, in Oxford. In 1524 he obtained the object of his petition; and in 1525, another bull, granting him permission to dissolve forty small monasteries.* In the visitation of the proscribed institutions, it was he folly or ill-fortune of Wolsey to employ the same individual that had already rendered the legatine court obnoxious by his arrogance and extortion. Represented by such a deputy, Wolsey experienced not only interruption from the lower orders of the people, who generally espouse the cause of the suffering party, but reproof from the king, who admonished him in strong but friendly terms, to avoid giving all future occasion to the "mumbling" and "murmuring" which pervaded the realm, upon the innovations which Wolsey had commenced.*

Undismayed by these checks, Wolsey proceeded to the application of the funds which the dissolution of the monasteries supplied. In 1525, the monastery of Saint Frideswide was despoiled of its revenues and endowments, its once flourishing community dispersed, and its buildings in part appropriated to the formation of a "College of secular priests," as Wolsey at first intended to designate his infant establishment. With systematic care, the Cardinal had already prepared students for his projected college, in his native town, at Ipswich, where, two years before, he had founded a school. In this tribute of gratitude to his birthplace, Wolsey had received great assistance. The magistrates of the town had wisely resigned the property vested in their hands for the maintenance of an ancient school to the Cardinal, whose power of appropriating them efficiently they knew to be superior to their own;† he was afterwards enabled also to add the revenues of twenty-four small monasteries to the means already stated. The regulations of the school he took also under his own charge, and framed them upon the model of those adopted at St. Paul's, by the excellent Colet. He even published, by his authority, a grammar, for the use of his Ipswich scholars, with a preface composed by himself,—the only effort of his pen in matters not connected with state affairs, or private business. But the grammar-school of Ipswich, being solely of local importance, survived not the hand by which it was founded; and this short-lived institution sunk, with Wolsey, into neglect and oblivion. The circumstance of its erection affords a pleasing proof of Wolsey's attachment to the

* Collier's Ecclesiastical History, vol. ii., p. 19.

* Wood's History of Oxford, edited by Gutch, vol. iii., p. 417, dissertation 6.

† Galt's Wolsey, p. 208.

scene of his childhood; and, if it be true that the insignia of a butcher's trade were carved upon one of its portals,* it furnishes evidence, not only of Wolsey's actual origin, but of the far more important fact, that he was superior to the littleness of remembering that origin with shame.

The magnificent institution of the cardinal at Oxford has obtained a more lasting celebrity than his inferior but equally meritorious design. Retained to us in the present day in the imposing structure of Christ Church College, this establishment sustained, in its infancy, curious and even threatening vicissitudes. In March, 1525, Wolsey laid the first stone, on the site of the former monastery of Saint Frideswide, the ceremony being solemnized by a sermon from Longland, Bishop of Lincoln, and enlivened by a sumptuous entertainment. The stone for the building was procured from quarries in the vicinity of Oxford; yet such was the extent and solidity of the masonry, that the expenses consumed in it amounted in one year to eight thousand pounds, a very considerable sum in those days. The church was adorned by Wolsey with a steeple, and a fine roof over the choir; but part of the edifice was taken down, in order to afford space for the erection of the choir. The endowment of the college with a dean, canons, and professors, was planned with liberality, and with a judicious attention to the real interests of religion and of learning. But Wolsey was not permitted to complete an undertaking which reflects the brightest lustre upon his prosperity. In his subsequent misfortunes, anxiety for his infant college, and concern for the deserted state into which it fell, formed one of the most painful sources of his frequent reflection. Henry eventually re-
1532. stored it; but monopolized to himself the glory of its existence, by assigning to it the name of King Henry the Eighth's College. It was, for various reaosns, endowed, in 1545, by the appellation by which it is now designated.

It affords a curious and instructive picture of the mind of Wolsey, to turn to the varying occupations in which he was engaged, even while he was called upon to effect that great change in the character of the country at large, produced by the dissolution of the monasteries. The people beheld him with astonishment descend to the direction of the royal children in the minutest particulars; and devote his energies alike to the regulation of a household and of a nation. The Duke of Richmond, the natural son of Henry the Eighth, and the Princess Mary, presumptive heiress to the crown, were alike intrusted to the charge and superintendence of the Cardinal. On the duke, who was his god-child, Wolsey bestowed sedulous and judicious attention, which was repaid by the merits and early proficiency of the young nobleman. With a care-
ful hand Wolsey framed 1525, 1526.
the household of Richmond, as soon as his godson had attained the age of six years: the regulations by which the miniature court was governed were dictated by the judgment, and subscribed in the handwriting of the Cardinal.* In a manner nearly similar, Wolsey arranged the establishment of the Princess Mary, and lent his great understanding to determine whether or not the princess should have "spice plates and dishes of silver;" and if a "trumpet and rebeks" were to be permitted for the solace of the young lady, or rather of her attendants.† Undaunted by the sneers of those who forget the importance of trifling details in the sum of human happiness, Wolsey next undertook the weary task of effecting a reformation in the ill-arranged and ill-governed household of the king. The particular abuses which he had to correct, are enumerated in a document entitled the "Statutes of Eltham;"‡ and they afford an amusing picture of the peculiarities of Henry, and of the manners of his court. The correcting hand of Wolsey was, of course, unwelcome, and unpopular; and, as is customary in the operations of a domestic revolution, the most arduous offices were the least approved. Among the numerous, indolent, and self-willed dependents, whom it was the duty of the Cardinal to eject from the service of his royal master, many enemies were added to those by whom Wolsey was already abundantly assailed.

The Palace of Hampton, nearly completed by Wolsey in the pre-
ceding year, was now pre- 1526.
sented by him to the king, the most splendid gift ever proffered

* Warton's History of English Poetry.

* Harleian MSS. in the British Museum, 589, 192.
† Ellis's Original Letters, vol. i., p. 271.
‡ Archæologia, vol. iii., p. 157, 158.

by any English subject to his sovereign. Wolsey, by this act, sought to evade the attacks of the envious and insidious courtiers, to whose snares he was exposed; but his discretion, in this instance, availed little. Henry, touched by the generosity of the Cardinal, gave him, in return, the ancient manor of Richmond, a favourite residence with the English kings, and especially with Henry the Seventh, by whose command its appellation was changed from Sheen to Richmond, in compliment to his title as Earl of Richmond in Yorkshire.* In this agreeable abode Wolsey kept his Christmas, in a manner far superior in splendour to the royal court, which was held at Eltham privately, on account of the sweating sickness. It was at once irritating to the nobles, and to the populace, to see the "butcher's dog," as they contumaciously expressed it, living in a royal residence. The unpopularity of Wolsey was, indeed, general. Already had they resented with bitterness the attempt made by the king, and attributed to the Cardinal, to raise a sum of money from the nation under the form of "a benevolence." The prohibition of games of chance increased the public irritation. A less judicious act of authority inflamed the passions of the people to the highest degree, whilst it proved that Wolsey possessed not that command over his own temper which it should be peculiarly the endeavour of a lawgiver or a ruler to acquire. In a play, or, as it was then termed, "a disguising," enacted by the young lawyers of Gray's Inn, a plot was introduced reflecting apparently upon the existing state of public affairs. The piece had, however, been written twenty years before the performance, and it might have been applied, from the general nature of the characters, by any minister in any times. Wolsey thought otherwise, and attributed the invention of this drama to hatred against himself. Under pretext that the king was highly offended with the piece, he committed John Roo, the author, to the Fleet Prison, and deprived him of his office of serjeant at law. The young performers were severely reprimanded, and one of them, who had figured as the principal hero of the piece, was threatened with imprisonment. Popular, and ill-suppressed murmurs followed this arbitrary measure. "He who grudges every man his pleasure," said the people, "spares not his own."

Events soon occurred, which afforded ample encouragement for expressions of a still more decided nature. A singular revolution had been for some time working in the affections and opinions of Henry the Eighth. He who, in the commencement of his reign, had deemed the decisions of the pope inferior only to those of heaven, and had recently upheld the papal power in his controversy with Luther; he, who had hitherto afforded to his subjects an example of conjugal felicity, began now both to question the authority of the pope, and to entertain the intention of repudiating his wife. When this change first began to operate on the mind of Henry; by whom or in what it was originated, and what share Wolsey had in effecting it, are points which have been variously stated by historians. It appears evident, that whatever may have been the sentiments of the Cardinal respecting the divorce, love, and not the counsels of the minister, suggested that measure to the ardent monarch. It is also undoubted that Wolsey viewed with chagrin and alarm the ascendency which the beautiful and accomplished Anne Boleyn had now acquired over the affections of the king. Before the temptations of ambition had weaned her from tenderer and more natural emotions, Anne had experienced the bitterness of disappointment in that "course of true love" which is said never to "run smooth." nor to return a second time to the channel of our affections. She occupied the place of maid of honour to Queen Katharine, while the young Lord Percy, son and heir of the Earl of Northumberland, attended in the household of Wolsey, for the purpose of instruction, among other youths of birth and fortune, who have been already described as a part of the Cardinal's establishment. It was the business of Lord Percy to await the pleasure of the Cardinal at court, where the hours of idleness and attendance were passed by him in Queen Katharine's chamber in pastime with the attractive, and, at that time, light-hearted Anne Boleyn. This casual circumstance had a considerable influence on the destiny of Wolsey; so wonderfully do the most trifling occurrences operate on great events. A mutual understanding soon took place between these two young and thoughtless persons, who were destined to experience the folly of cherishing schemes

* Lysons's Environs of London, p. 443.

of domestic happiness in courts. Their attachment was soon perceived, and was highly displeasing to the king, who, hastening to Wolsey, entreated him to frustrate the projected engagement, revealing, at the same time, his own secret partiality for the fair mistress of Lord Percy. Wolsey, in consternation at this discovery, was yet too well acquainted with the character of Henry, to hesitate complying with his commands. The lovers' vows were, at his interference, and upon the interdiction of the Earl of Northumberland, irrevocably cancelled, and the hero of the adventure constrained to enter into a contract of marriage with a woman whom he loved not. Anne never forgave the Cardinal for his part in this affair, and, upon her return to court after a temporary retirement, became his determined though not avowed enemy.

Those courtiers and privy councillors who beheld with satisfaction the predilection of the king for Anne Boleyn, formed a party against Wolsey, who fell the victim of their machinations. To remove him from the presence of the king became the object of Wolsey's enemies; and a favourable opportunity for the execution of this design was furnished by the singular crisis which had recently taken place in the affairs of Europe.

The balance of power, long supposed by Henry the Eighth to owe its conservation to his own political skill and influence, began now to lean to the side of the emperor. Francis the First, lately released from a degrading imprisonment; the pope Clement the Seventh still a captive in the castle of Saint Angelo; and Henry, impoverished by the bad management of his financial concerns, offered but a feeble opposition to the power of Charles.

1527.

To negotiate personally with the king of France was the task now intrusted to the Cardinal, whose abilities and accustomed grandeur rendered him an efficient and an imposing representative of his sovereign. Accordingly, when the splendid preparations which he deemed necessary were completed, Wolsey set out, on the 3rd of June, 1527, with a procession similar in its arrangement but superior in numbers and in magnificence to the train with which he usually journeyed. In his way to Canterbury he rested either at the houses of the nobility, or at the larger abbeys; for in those days inns were both rare, and unfit for the reception of guests of the higher classes; farm-houses, convents, and the mansions of the great supplied the place of those establishments which are now indispensable to the traveller; and however the independence of the visitant might be compromised by the obligation received, his comforts were probably ensured by the substitute. At Canterbury the Cardinal was lodged in the abbey of Christ Church, where he waited for three or four days, in order to celebrate the festival of St. Thomas, the patron saint of the abbey. Here Wolsey signalized his devotion to the imprisoned pope, by commanding that the litany, sung on the feast day, should contain an appeal to the Virgin in favour of Clement. Kneeling at the door of the choir, the monks and choristers standing in solemn array in the body of the abbey, Wolsey was observed to shed tears of pious grief, on account of the captive pontiff to whose honours he had but recently aspired. May we not conjecture that some mournful presentiment, some sad misgivings with respect to his own reverse of fortune, might mingle with that sorrow which was attributed, by the spectators, only to compassion for another?

After a fatiguing passage, Wolsey reached Calais, which he entered in solemn procession, first performing his devotions in the portal of the Lantern gate, before he entered the town. Here he rested some days, from indisposition; but, after all his train and carriages were landed, pursued his journey towards Boulogne, first addressing his attendants on the propriety of caution in their intercourse with the French nation; towards whom strong national distrust was harboured even by the experienced and liberal Wolsey.* After this exhortation, he proceeded to Boulogne, and thence to Montreuil and Abbeville; honoured, on his passage through those towns, with processions and pageants, which he repayed as he went, by proclaiming certain days of freedom for sins, a mode of remission on which even intelligent and devout men were disposed, at that time, to rely. Wolsey was empowered by Francis to distribute temporal forgiveness to the offenders confined in the prisons of the various towns through which he passed; a privilege hitherto vested solely in the monarch, who usually exercised it during his progresses.†

* Cavendish, p. 155.
† Singer's Cavendish, p. 158.

From Abbeville, Wolsey travelled onwards to meet Francis, and crossing the river Somme, he rested for a short time at the castle of Picquigny. From this romantic abode, which was thought, by his English followers, to resemble Windsor, Wolsey hastened towards Amiens, and meeting Francis near that city, he and the king entered it together, "making," as Cavendish, who was an eye-witness, observed, "such wonderful cheer one to another, as if they had been of an old acquaintance." At Amiens, Francis and Wolsey remained for a fortnight, which they spent in banqueting and in consulting; concluding the more serious part of their occupations with a compact, solemnly implied in the mutual participation of the sacrament, between the king of France, and Wolsey, on the part of the king of England. At Compiégne, whither they afterwards repaired, a still closer intimacy was formed between the French king and the English minister; but Wolsey was too much of a veteran in politics to allow his courtesy to interfere with the interests of his embassy. The chancellor of France, having on some occasion offended him, Wolsey gave way to a paroxysm of anger, which it required all the address of Louise, the mother of Francis, to allay. By this manœuvre the Cardinal gained some concession in the negotiation which had hitherto been withholden, and he established his ascendency over the French council, whom Cavendish describes as "having their heads under his girdle."

After witnessing, among other diversions, that of a boar-hunt, a novel scene to the Englishmen, Wolsey prepared to return, wearied with these courtly revels, and disgusted with the knavery and ridicule of the French, who both insulted him with derision, and robbed him of plate and furniture. At home, mortification of a more serious nature awaited him, and he experienced a cold reception from the king, whom he joined at the house of Sir Henry Wyatt, in Kent; nevertheless he remained for some days with the court, and then adjourned to his own mansion, at Whitehall. Shortly afterwards he resumed the trust of the great seal, which had been assigned by letters-patent to the guardianship of Doctor Taylor, master of the rolls, during the absence of Wolsey; the laws of England not permitting that this important instrument should be carried without the realm. A meeting of the nobility and great law officers being held in the Star Chamber, Wolsey unfolded the result of his late mission, and announced the approaching arrival of a grand embassy from France. In this harangue the Cardinal boasted of the benefits which would accrue from the alliance about to be concluded between France and England: he extolled the splendour of the embassy which should complete this important measure: unhappily, the distinguished persons of whom it was composed, were decreed by chance to behold his ruin.

Early in October, the metropolis was enlivened by the arrival of five French noblemen, among whom was Du Bellay, bishop of Bayonne, a man of lively observation, and to whose letters, published by Le Grand, we are indebted for many interesting particulars of the strange scenes which he witnessed during the continuance of his mission. For some time after the appearance of the ambassadors no symptoms appeared of the alienation which Henry afterwards displayed towards his minister. On the conclusion of a treaty of peace between the two states, the Cardinal celebrated mass in presence of the king, of the foreign noblemen, and of an assemblage of the chief persons of rank or power at the English court. The king, after his usual custom, rode home to dinner with the cardinal, and even arranged that Wolsey should provide a banquet at Hampton Court, to regale him and the ambassadors, after hunting the next day in the royal park at Richmond. All was now bustle and preparation in the household of Wolsey. The caterers and purveyors procured the finest viands they could get for "money or friendship, among my lord's friends."* The cooks wrought both day and night; the yeomen of the chambers were busied in hanging the apartments of the stately edifice with costly draperies, and in furnishing them with silken beds. There was carriage and re-carriage of plate; for the fashion of having cupboards or sideboards with several compartments, in the banqueting room, required a rich and often inconvenient display of that costly article, then doubly precious from its recent introduction. The splendour of the scene was made wholly visible by two immense candlesticks of silver, valued at three hundred marks each, holding torches, the light of which was

* See Cavendish.

reflected by large plates of silver gilt. The viands and the wines equalled the decorations in richness and excellence; and the tenour of the entertainment was, to all appearance, such as to satisfy the most fastidious guests, and the most anxious and punctilious host. Yet while some envied and all admired the magnificence of the Cardinal, secret and corroding care filled his breast,—for the king danced with Anne Boleyn; and it was on this occasion that Du Bellay observed that public attention was first riveted upon the passion which Henry could not conceal, and which Wolsey could not but dread. It was not long before the unfortunate minister received a full confirmation of all his fears; and the embarrassing question of the divorce was explicitly unfolded to him by the king. Long and earnest were the entreaties and arguments which Wolsey urged, to dissuade him from the project of paving the way to his marriage with Anne, by a divorce from the virtuous and respected Katharine, whose infirmities of constitution, and decline in personal charms, had far more influence in deciding her consort to adopt this measure, than the plausible, but equivocal plea of conscientious scruples concerning the validity of his marriage.

The conduct of Wolsey throughout the whole affair of the divorce has been variously represented; but little can be pronounced with certainty upon his real opinions and motives. When the peculiar circumstances to which he was obliged to yield are considered, and the character of the monarch whom it was certain ruin to displease, is recollected, it is probable that, in the first stage of the business, the divorce was approved by Wolsey, and that his actions may have been influenced by enmity to the Emperor Charles, the nephew of the Queen, and his devotion to the interests of Francis, who desired an union between the Princess Renée, his sister-in-law, and the King of England. The most partial admirers of Wolsey cannot represent him with justice as a man rendered inaccessible, by a high sense of honour, to considerations of personal interest, or even of personal feelings. When the dispositions of Henry in the affair were developed, and when Wolsey found, that, instead of strengthening his foreign connexions, he was assisting in the elevation of a domestic enemy, he was seized with consternation, and endeavoured, too late, to recede. He could not fail to perceive what was obvious to a less interested observer, that whichever way the question terminated, it would involve his ruin.* Anne, whether raised triumphant to the throne, or dejected by defeat, would still remain his enemy; and Wolsey, who affirmed of the king that "he could never persuade him from his will and appetite," knew well the effects of female influence upon that susceptible, yet brutal monarch.

From this time the fate of Wolsey was decided, as far as it is permitted to human agents to determine the lot of a fellow-mortal. He sought, indeed, to avert the coming storm, and to throw all responsibility from his own shoulders, by an appeal to the English and foreign universities concerning the validity of the divorce; and he persuaded Henry to demand the opinions of the bishops on the momentous question. Unfortunately for Wolsey, each of these applications to clerical subserviency was favourable to the divorce; and Henry, emboldened by this partial success, rested not until he had obtained from Clement the Seventh a bull, empowering Cardinal Campeggio and Wolsey to hold a legatine court, in which the cause nearest his heart might be heard, and determined. The result of this proceeding hastened the ruin of Wolsey, and his conduct in the matter was never cordially forgiven by Henry. Averse, as a zealous, though liberal Catholic, from a process which impugned the validity of the papal dispensation, which at no very distant period had permitted Henry and Katharine to marry, Wolsey felt the strongest inclination to defer, or to decline the decision required from him and Campeggio; and at the close of the memorable and singular trial, he evinced the same disposition in which the validity of the marriage was argued. It was the lot of Wolsey to be obnoxious to both the parties by which the court and country were at this time divided. The partisans of Anne were his most powerful enemies; but the advocates of Queen Katharine's cause were equally clamorous against him. Harassed and perplexed, he endeavoured to justify himself, through the king, from any participation in the first suggestion of the divorce, which report ascribed to his counsels, conveyed, it was affirmed, to the king's ear by his intimate friend, Longland, the royal confessor. The solemn asseveration of Henry, before the legatine court, that Wolsey

* Le Grand.

was guiltless of the unpopular measure, received little credence. Katharine, whom it was the office of Wolsey and his colleague to visit and to conciliate, expressed with the ingenuous warmth of a fearless and exalted mind, her unshaken conviction of his secret enmity, and of its fatal effects. Yet, if this accusation were just, the conduct of the Cardinal when he had the whole affair of the divorce in his own hands, is incomprehensible. Instead of hastening the conclusion of a measure of which he was himself supposed to be the first originator, he deferred the decision of the king's appeal from day to day, until the impetuous temper of Henry could no longer brook delays which he deemed unnecessary. The vacillation with which for the first time the Cardinal acted, is wholly unaccountable, except upon the supposition of some secret change in his private sentiments upon the point in agitation. Distracted and bewildered, he betrayed a lamentable deficiency of that manly resolution, so characteristic of his nature, which might have availed something even with Henry, and which would have redeemed him from the utter degradation that attended his fall. The unhappy Wolsey now experienced the bitterness of a servitude in which opinion at least, if not conscience, is at variance with interest. Well might he afterwards regret, with the bitterness of an unavailing, because a late repentance, that his days had been devoted to an earthly, rather than a heavenly Master. Well might he contemn the vanity of human desires, when he reflected on the peaceful tenour of a life, unruffled by the turmoils of ambition, free from those shackles which the lust of power forges, and passed in rendering, as offerings to heaven, works of active benevolence to man.

Formed by nature for a nobler sphere than the court of a capricious and pampered tyrant, the spirits of Wolsey began to sink under the accumulated annoyance inflicted by the ill-suppressed triumph of insolent enemies, and the indulged fury of the king. At the close of the court one day, Henry sent for him to his residence at Bridewell, and he remained in the private apartments of his sovereign for more than an hour. At the end of that time the Cardinal entered his barge at Black-Friars, and went to his own palace at Westminster. The Bishop of Carlisle, who was with him in the boat, remarked that "it was a very hot day." "Yes," replied Wolsey, "and if you had been as much chafed as I have been within this hour, you would indeed say it were very hot." Upon entering York House, the Cardinal hurried to bed, but was not long permitted to enjoy repose, for the Earl of Wiltshire was obliged soon to rouse him, with a message from the king, requiring the immediate interposition of Wolsey and his colleague, with the queen, who was then at the royal abode. Fatigued and harassed as he was, the Cardinal could not delay complying with this order, and accordingly returned to Bridewell, where he had to encounter the resentful demeanour of the queen; and this day of anxiety and mortification was terminated by another interview with Henry, to whom he could communicate nothing but the inveterate determination of Katharine against yielding to her fate.*

These occurrences were succeeded by a quarrel between Wolsey and Brandon, Duke of Suffolk, the intimate associate of the king. It was a plain intimation of the temper of Henry, when Brandon, an experienced and dexterous courtier, ventured to attack the minister, once so formidable, and once his friend, to whom he many times had owed kind offices of mediation with the king. The enemies of Wolsey were becoming daily more numerous and confident, when Henry prepared to set out on his summer progress, accompanied by Anne Boleyn, and breathing all the violence of his furious nature against the two legates. His indignation was excited to the utmost by the adjournment of the legatine court until Bartholomew-tide, a measure adopted by the two legates, in order to avoid the necessity of a decision, but under the pretext of a similar regulation in the courts at Rome.

Campeggio, weary of his office, and anxious to return to Rome, determined to leave the conclusion of this tedious process to other hands; and finding that the mission of Stephens, the king's secretary, who had been sent to Rome to obtain from the pope authority to pronounce judgment, had been fruitless, he resolved to follow the king on his journey, in order to signify his departure, and to take his leave. He was joined in this excursion by Wolsey, and the Cardinal, on this occasion, beheld for the last time, the monarch over whose mind he had exercised, for many years, an influence unparalleled, and

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* Cavendish, p. 225—229.

almost absolute. His ruin appears to have been generally expected before the final explosion of the king's anger; for, on the arrival of the two cardinals at Grafton, in Northamptonshire, where the court rested, there arose, as Cavendish avers, "divers opinions that the king would not speak with the lord cardinal, and thereupon were laid many great wagers." On reaching the entrance of the court, Campeggio was immediately conducted to an apartment prepared for him, and Wolsey, after having accompanied his colleague to his chamber, expected to be led to his own, but he was struck with dismay on hearing that no orders for his accommodation had been issued. In this dilemma, the courtesy of Sir Henry Norris, a young and favoured attendant of the king, relieved, in some degree, the perplexity of the Cardinal. Norris, who was afterwards executed upon a charge of supposed criminality with Anne Boleyn, evinced, in this instance, a delicacy and kindness of feeling which proved him deserving of a less tyrannical master, and of a happier fate. Affecting to ascribe the manifest neglect of the Cardinal to the limited establishment of the king's present residence, the knight begged that Wolsey would accept his own apartment, an offer which the dejected favourite accepted with gratitude, and, while he changed his riding apparel, gained from Norris such details of the king's expressions towards him of anger and alienation as were current about the court. Thus warned, Wolsey was the better prepared to enter upon his defence, if opportunity should be allowed, in a place where he had few friends to intercede, even for the poor privilege of being heard before condemnation. Affairs seemed, however, for a short time, to change their aspect. Wolsey, to the discomfiture of those who had stakes depending on a contrary result, was bidden to the royal presence; and was admitted with Campeggio to the chamber where the lords of council were in waiting for the king. Henry, on his entrance, either acted with a degree of feeling unusual to him, or he was softened by the presence of the man whose talents had long lent a charm to his social hours, and whose counsels had exalted the glory of England in foreign lands. He received Wolsey courteously, and even kindly; raised him from his kneeling posture, and leading him by the hand to the recess of a window, conversed with him long and earnestly. The explanation which then took place was favourable, as far as the attentive Cavendish could gather the discourse, to the restoration of Wolsey's favour; yet this temporary sunshine was soon obscured by the fascinations of Anne Boleyn, with whom the king dined that day. Whilst she, the idol of his passing affections, was undermining the fortunes of the Cardinal with her princely lover, the Duke of Norfolk, her uncle, could not suppress his exultations over the unhappy Wolsey, at dinner, and even threw out the alarming insinuation that it was the intention of the king to send Wolsey to his diocese of York, which he had never yet visited.

Thus assailed on all sides, Wolsey prepared to depart. His enemies had prevailed; and when he took leave, on the following day, in order to accompany Campeggio to London, the separation between him and the king was final. Wolsey had slept during the night at Euston, and on rejoining the court early in the morning, he found Henry accoutred for a sylvan excursion with Anne Boleyn, who had prepared a repast for the king in a neighbouring park, in order to prevent any subsequent interview between him and his former favourite.

In this hasty manner did these two men, long associated in the various pursuits of their several stations, bid each other a last farewell. Henry, in the company of his mistress, passed the day, it is to be presumed, with a careless gaiety, very different from the sad frame of mind in which Wolsey retraced his steps towards London. At the monastery of Saint Alban's, he parted from Campeggio, who, happier, though less distinguished than his colleague, journeyed in safety to his native land, after a slight disturbance of his progress, occasioned by the groundless suspicions of Henry, that Wolsey had transmitted, through Campeggio, the means of provision for himself in case of his escape to foreign lands. Wolsey had not, apparently, harboured any such intention. He returned to York House, and, on the commencement of the Michaelmas term, took his accustomed place, for one day, in the Court of Chancery, and exercised his high functions with his wonted parade. After this day he never sat there more. The ensuing morning he remained at home to receive the Dukes of Norfolk and Suffolk, the purport of whose visit was

to demand from him the great seal. At the same time it was intimated that the king commanded him to leave York House, and to take up his abode at Esher, a residence appertaining to the bishopric of Winchester, and situated in the well known and beautiful vicinage of Hampton Court. Wolsey, with singular calmness, requested to know by what authority the two noblemen acted; they replied by that of the king. The Cardinal then protested against obedience to a verbal order, and refused to give up his office without the formality of letters-patent from the king, from whom he had received the seal. In vain the two dukes urged compliance with their orders; they were constrained to return to Windsor, and to bring with them, on the following day, the letters with the royal signature. These documents having been perused by Wolsey, with every appearance of respect and submission, he yielded to his fate, and resigned into the hands of the noble messengers the insignia of his high office. The dukes then left him, and Wolsey prepared to leave York House, and to take a last survey of the costly furniture with which his lavish hands had supplied the princely abode. How must the entire vanity of human grandeur have struck his mind when he looked around upon the decorations of his stately mansion,—the spacious gallery, occupied by various tables, on which were deposited large pieces of silk stuffs, of velvets, and of satins, the rich hoards of the Cardinal for future use;—the store of one thousand pieces of Holland cloth,—hangings along the walls of the gallery, cloths of gold and of silver, and precious tissues of various kinds:—sumptuous copes, intended for the clergy of his colleges at Oxford and at Ipswich, provided at his private expense;—in the adjoining chambers, long tables, laden with massive plate, both silver and gold, which was valuable and uncommon at a period when the use of pewter vessels, even in the households of the great, was scarcely abandoned! After a minute inspection of his property, Wolsey caused it to be carefully arranged, and the several articles to be entered in an inventory, which is still preserved among the Harleian collection of manuscripts in the British Museum. By this enumeration of his goods, and by collecting even those which were broken or spoiled, Wolsey probably hoped to conciliate his rapacious master, in evincing his submissive devotion to his will. He next allotted to each officer of the household his respective charge, and leaving strict injunctions that each portion of the spoils should be delivered to those who were empowered to receive it on the part of the king, he departed from York House. His last action in this scene of his former greatness, evinced how unsubdued was his proud spirit, by that reverse of fortune which afterwards bowed it to the dust. When he intrusted to Sir William Gascoigne, his treasurer, the superintendence of the forfeited property, the knight ventured to condole with him on the prospect of his being sent to the Tower, a fate which public report had already assigned to the Cardinal. For this surmise, Gascoigne received from Wolsey a sharp rebuke. "Is this," said he, "the good comfort and counsel that ye give your master in adversity? It has always been your natural inclination to be very light of credit, and much lighter in reporting false news. Go your way, and give good attendance unto your charge, that nothing be embezzled."

The Cardinal, attended by a selected number of his servants, now set out on his way to Esher, and entering his barge, at his private stairs, was rowed to Putney, where his mule, and the horses of his attendants, awaited him. Scarcely had he begun his journey, when his heart was gladdened by the approach of Sir Henry Norris, who hailed him with the glad tidings that "the king commanded his grace to be of good cheer;" and assured him that he "was in as much favour as he had ever been." With these encouraging words, Sir Henry delivered to Wolsey a ring, which had long served as a token between him and the king upon particular occasions. The surprise and delight with which Wolsey received these indications of mercy were promptly expressed in his gestures. Alighting from his mule, he prostrated himself on the earth, holding up his hands to heaven in joy and gratitude. The courteous Norris was lost for some minutes in thought and wonder, at the abasement of one whom he had seen the idol of courts and of princes. Placing himself also on his knees, by the side of Wolsey, he besought him to give credence to his message. Wolsey, overwhelmed with his emotions, could reply only by reiterated expressions of thankfulness to

God and the king; but it is to be feared that feelings of earthly ambition had the predominating influence over his mind. On parting, he gave to Norris, as a token of his friendship, a piece of the holy cross, commonly worn by the Cardinal around his neck. To the king he sent many messages of devotion; and recollecting, after taking leave of Norris, that Henry prized a favourite fool whom he had in his service, he recalled the knight, and bade the menial accompany him to the king; but the poor fool, preferring the service of his old master, could with difficulty be forced from the retinue; and the Cardinal had some thoughts of sending six of his stoutest yeomen to enforce the obedience of the attached and perhaps humoured individual.*

Wolsey now proceeded to Esher, where he remained for some weeks in a state of anxiety and of privation which afforded a melancholy contrast to his former splendour. An information had been exhibited against him, in the king's bench, by Hales, the attorney-general, purporting, that, notwithstanding the statute of Richard the Second against procuring bulls from Rome, he had procured bulls for his legatine power, which he had for some years executed. This charge had even been preferred at the commencement of Michaelmas term, before the last appearance of the Cardinal in chancery. Wolsey, through his attorneys, confessed its justice, as far as regarded the procuring of bulls, but denied that the procedure was contrary to the statute, or prejudicial to the honour and interests of the king: he was, however, declared by the court to be out of the protection of the king; his lands and goods to be forfeited to the crown, and his person to be liable to seizure. The people,† although generally unfavourable to Wolsey, regarded this sentence as harsh and unjust. The Cardinal had exercised his legatine jurisdiction with the countenance of the king, and had never been questioned as to its legality. His services to the crown were not wholly obliterated from the public recollection, and he, who had been the object of envy, now became that of compassion. Deprived of all his personal property, the state of penury to which he was reduced seemed scandalous to the high station which he still occupied as Cardinal, and as the nominal Archbishop of York. His household, as Cavendish, who was still a member of it, relates, was destitute of beds, linen, cups, dishes, and plate, which they were obliged to borrow from Sir Thomas Arundell and the Bishop of Carlisle. This sudden reduction of the Cardinal's fortunes was not solely the effect of caprice and violence on the part of Henry, who inherited much of the grasping disposition of his father, and was determined to obtain possession of York House, the inspection of which had probably sharpened his appetite for the plunder of the Cardinal's effects. After a private negotiation with Wolsey, this point was conceded, and the splendid palace, which would have reverted to the church as an appendage to the see of York, was secured, by this piece of management, to the king, on the condition, that it should, on his death, be returned to the successor of Wolsey in the archbishopric. The effects of the Cardinal's submission were soon apparent. On the twenty-first of November he received the king's pardon, and was reinstated in the sees of York and Winchester. At the same time a number of his horses and mules were restored to him, and three thousand pounds in money.* These, with other articles, amounted altogether to six thousand, three hundred, and seventy-four pounds, which was all the wreck of his immense property that Wolsey ever received, after it had fallen into the hands of his rapacious master.

The indications of a relenting spirit on the part of the king towards Wolsey, were viewed with some alarm by the enemies of the Cardinal, who feared him more in adversity than in prosperity; for they knew how keen would be his vengeance, if he ever were reinstated in his former greatness. By their representations, the offences of Wolsey were magnified in the eyes of Henry, until the mind of that monarch was worked up to a determination to complete the ruin of his former favourite. By a council of nobles, assembled in the Star Chamber, it was resolved to refer the case of Wolsey to parliament; a bill was accordingly prepared, attainting Wolsey of high treason, and it passed through the house of lords. The articles contained in this bill were forty-four in

* Cavendish, p. 257. † Herbert, p. 292.

* Rymer's Fœdera, vol. xiv., p. 375. The horses and their furniture were valued at one pound seventeen shillings each.

number, and related chiefly to the abuses of the Cardinal's legatine authority. In some clauses of the bill he is charged with an usurpation of the royal jurisdiction, and with presumption in assuming the royal style in his dispatches to foreign courts. He is attacked, also, on the score of fraudulent and unjust transactions with the clergy; with the illegal suppression of monastic houses containing more persons than were specified in the bulls which he had received from Rome; and with the sin of having slandered many virtuous members of the conventual establishments. The diminution of hospitality and charity were also imputed as crimes to Wolsey, as well as other improprieties connected with the dissolution of monasteries. With regard to these charges, it must be recollected, that the measures adopted by the Cardinal were in most instances known and sanctioned by the king. The fraud and extortion of which he was accused cannot be considered as proved, because he was never allowed to answer the charges brought against him. The acts of oppression which he was said to have authorized in his transactions with the monastic orders, were trifling, compared with those afterwards committed by Cromwell and his agents in the work of suppression, and which were even encouraged by the king, whose avarice evidently increased with his years. This fact throws an air of injustice over the attainder, and confirms the opinion of Lord Herbert, that no man, who fell from a high station, had fewer crimes attributed to him on reasonable grounds. There is something almost ridiculous in the passages of this famous bill, which tax Wolsey with "consuming too much time with a fair tale in the council;" with "allowing no opposition," but "overwhelming it with his accustomable words, so that the members were better hold their peace than speak," for "he would have all the words to himself." Several other articles must have appeared equally puerile to those who were not burning with envy, or trembling with fear of the once pompous ruler of the council. Nor can posterity assent to the justice of the imputation which affixes to Wolsey the character of an "impeacher and disturber of due and direct correction of heresies," from his having prohibited the exertions of two bishops in their projected interference with a party of Lutheran students in Cambridge. The subsequent conduct of Henry vindicates the Cardinal also from the charge of having "greatly overshadowed, for a long season, the king's honour, and of having subverted the due course and order of the laws, to the undoing of a great number of the people."* When the administration of Wolsey ceased, the glory of Henry expired. All that was elevated in the character of this monarch seemed to have been banished with the minister. The spirit of improvement languished at home; the estimation of the English nation at foreign courts declined. The passions of the king actuated his counsels, and caused the oppression and slaughter of his people. The persecutions of his later years had received no sanction from the previous example of Wolsey. The burning of heretics, although frequent at this time in the diocese of Canterbury, had never been recorded within the ample limits of Wolsey's ecclesiastical jurisdiction. The immoral tendency of his example may be questioned, as far as it affected the king. During the ministry of Wolsey, Henry, for nearly eighteen years, remained contented with one wife, if not constant to her during the whole of that period; and the violent indulgence of his passions during his later years attests that some restraining hand must have curbed them in the more dangerous season of youth. The change which was so evident after Wolsey's fall, both in the character and administration of Henry, sufficiently exculpate the Cardinal from having diminished the reputation of his sovereign.

Sentiments of this nature may perhaps have actuated the members of the parliament, upon the introduction of the bill of attainder into that assembly. Before any decisive step was taken, the cause of Wolsey was effectually espoused by Thomas Cromwell, an individual hitherto of humble fortunes, who resided under his roof in the capacity of secretary. This office, which had been held by the celebrated Sir Thomas More, the successor of Wolsey as chancellor, and by Gardiner, his successor in the see of Winchester, was in all three instances the stepping-stone to preferments apparently little expected by any one of these eminent men. More seems not to have cherished very favourable sentiments towards Wolsey. Gardiner was too sedulously bent upon his

* Herbert, p. 302.

own elevation, to extend any assistance towards a sinking benefactor; Cromwell, alone, though possessed of as much ambition as either of his former associates, evinced a degree of constancy towards his benefactor deserving of peculiar commendation, when it is recollected how arbitrary a monarch he had to serve. On being informed of the danger which threatened his patron, he hastened to London, and taking the seat of a friend, in the house of commons, defended Wolsey with so much energy and discretion, that the bill of attainder was flung out. It is in favour of Wolsey's innocence, that the answers with which Cavendish influenced this assembly, were dictated by the Cardinal, who, from hour to hour, gave most precisely his instructions. Yet this suspension of misfortune was productive of little immediate consolation to Wolsey, whose situation, during his continuance at Esher, presents a scene of mortifying deprivation and distress. Already had he been reduced to one of the most humiliating extremities that could befal a man of his character, that of being indebted to his domestics. Their fidelity was manifested by their refusal to quit him, even when he had confessed his inability to repay their services with the usual stipends. In this emergency Cromwell suggested an expedient, of which he set the first example. He recommended that the chaplains of the Cardinal, whom he had provided with livings, should each contribute some portion of their funds to the discharge of the wages due to the inferior servants. This plan succeeded; each of the chaplains throwing into the common fund as much as his means allowed, and Cromwell giving the first five pounds. After an affecting address to his household, whom he could not behold without tears, Wolsey distributed a portion of their wages amongst them, and they repaired to the hall, when some determined to go home to their friends, others to remain until the fortunes of their master should be improved. But there seemed little prospect that the hopes of these faithful followers would be gratified. The spirits of Wolsey were alternately raised or depressed by cheering or humiliating messages from the court, and by acts of unexpected kindness or of wanton insult. His lively sense of the cruelty exercised against him was plainly shown in the letters which he addressed, about this time, to Cromwell and to Gardiner whose good offices he humbly solicited. At length his health gave way under the pressure of mental anguish, and the king was informed of his declining state. By the royal command, Doctor Butts, a court physician, was sent to attend the Cardinal; and he declared his conviction that Wolsey would fall a victim to his disorder, if his distress of mind were not alleviated. Influenced by this opinion, the king and Anne Boleyn now endeavoured, by acts of kindness, to soothe the irritations of the man whom Henry had not wholly ceased to value. These flattering, but transitory, gleams of favour soon revived the drooping frame of Wolsey, and his recovery was accelerated by the renewed comforts of his habitation, some of his furniture and other property being added to that which had been already restored. Change of scene was also permitted; and, through the intercession of Cromwell, he was allowed to remove to the lodge in the king's park, at Richmond, where he remained for some time in great comfort, although with a small number of servants, suited to the size of the dwelling. This pleasant abode Wolsey quitted for one still more calm, and even better calculated to quiet the tumultuous passions which had long held sway in his breast. In the beginning of Lent he entered the monastery of Carthusian friars, and occupied a lodging which the pious founder of Saint Paul's school, Dean Colet, had formerly prepared for his own retreat from a world, even to the virtuous, unsatisfactory. From the apartment in which Wolsey abode, a gallery led into the church, where he repaired every afternoon to service; and often would he sit in his cell, seriously conversing with one or other of the brotherhood, who dissuaded him from fixing his affection on the vain glory of his former state, and recommended to him acts of penance and habits of contemplation, fitted to aid the awful preparation for another world, whither he was shortly summoned.

It had been for sometime determined that Wolsey should remove to his archbishopric, a plan to which he no longer felt any repugnance, for he was now hopeless of effecting any change in the disposition of the king towards him. All prospect of personal intercourse with Henry was at an end; for it was universally understood, that he had

promised Anne Boleyn never to see him more.*

Through the exertions of Cromwell a thousand marks were with difficulty granted by the council, in advance, out of the revenues of Winchester, to defray the charge of his journey. The necessary arrangements being completed, he set out for York, in those days a formidable expedition; and it is observable, that he proceeded no farther on the first day than Hendon, in Middlesex, scarcely eight miles from London; and here he rested for a night in the monastery of Saint John. The rest of his journey was made with still greater deliberation; the Cardinal resting at different abbeys to perform the numerous ceremonies appointed for the remarkable days so frequently occurring in the calendar of the Roman Catholic church. The archiepiscopal palace was at this time under repair, and Wolsey was obliged to accept the loan of a prebend's house at Southwell, about four miles from Newark, where he remained until Whitsuntide. He now conducted himself in a manner becoming a high dignitary of the church, and worthy of a Christian. His demeanour was affable without familiarity, decorous but not rigid, and liberal without profusion. To the gentry of the country, who resorted in great number to his abode, he showed a dignified and courteous hospitality. To the poor, and to all the lower classes, he evinced a charitable concern for their interests, which was long remembered by them with gratitude. "He gave to bishops," says a contemporary writer, "a right good example how they might win men's hearts."† He enforced the custom, then by no means general, of preaching sermons to the people; and frequently rode on holy days from church to church, enjoining the inferior clergy to perform this duty. He said mass among the people, and afterwards exhibited the fulfilment of a vital principle of religion, by causing the priests to compose any differences which might happen to exist among their flocks. He even accomplished the difficult task of soothing feminine resentments; and reconciled several married persons who had long lived in disunion. He restored dilapidated churches which had been applied to temporal purposes, and re-established the service of God in them. In these meritorious occupations Wolsey passed the period of his exile from the court, and doubtless, in the fulfilment of his duties, experienced a degree of calm enjoyment, to which he had hitherto been a stranger. While he joined with moderation in the social pleasures of the neighbourhood, he avoided, both from policy and a sense of propriety, such diversions as were likely to excite public animadversion, or to renew the displeasure of the king. Hence he resolutely withstood the temptations thrown in his path by the surrounding gentry to partake in the amusement of stag-hunting, to which he was extremely partial; and when he could escape it in no other manner, he avoided the allurement by a stratagem.* He now thought it expedient to leave Southwell, and to remain until Michaelmas at Scroby, another episcopal residence, whence he removed to Cawood castle, situated within seven miles of York. Both at Southwell and Scroby he left a reputation for wisdom, charity and piety, which won over to him his enemies in those districts, and caused him to be renowned as a benefactor.† At Cawood he began to make preparations for his installation into the archbishopric of York; a measure which unhappily accelerated his ruin, although it could not, with propriety, be deferred, consistently with the practice and ceremonials of the church. On this occasion, Wolsey displayed a prudent determination to avoid unnecessary parade and expense; and had not his scanty means been augmented by liberal donations from the neighbouring clergy and gentlemen, of oxen, sheep, wild-fowl, and other viands, but a poor provision would have been made for the installation feast. He was not, however, permitted to enjoy the manifestations of the respect which he had inspired in his diocese; and the very day that their well-meant offerings were deposited in his premises, he was destined to encounter the crisis of his misfortunes.

His ruin had long been decided, and his enemies only paused to consider in what mode, and at what moment, it could be most effectually completed. The popularity of the Cardinal in his

* Le Grand.

† Cavendish, p. 318. See note, from a book printed in 1536, and entitled, a Remedy for Sedition.

* Cavendish, p. 332. † Ib p. 327.

northern diocese, and his intended installation, increased the dread with which his adversaries in the council still regarded him; and they plainly perceived that all affection for Wolsey had not been wholly extinguished in the bosom of Henry. It would be difficult to conceive in what manner the king could have been persuaded to a conduct so inconsistent as that which he now adopted. Already had the Cardinal been acquitted in parliament of the treasonable charges brought against him, and the king had since manifested his sense of the propriety of that decision, by acts of renewed kindness to the fallen minister, and by messages expressive of his favour; yet the capricious monarch now consented that the unfortunate Wolsey should be arrested for treason, and brought to London to stand his trial. By Wolsey this fresh calamity appears to have been wholly unexpected; and although the suspicions of his attendants had been in some degree roused by the hasty visit of two gentlemen from the king, and their superstitious fears excited by the accidental circumstance of the Cardinal's cross falling upon the head of one of his chaplains, yet no misgivings are stated to have disturbed the serenity of mind which he himself enjoyed before his final impeachment.

It was about noon, just after the Cardinal had dined, and before his household had finished their repast, that the hall of Cawood Castle was suddenly filled with gentlemen and retainers, conducted by Henry Earl of Northumberland, and Sir Walter Walsh, one of the gentlemen of the king's privy chamber. The earl, on his entrance, commanded the porter, in the king's name, to deliver to him the keys of the castle; an order which was stoutly resisted by the trusty servant, who refused to resign what he had sworn to keep faithfully; and Lord Percy was obliged to leave them in his charge, with the security of an oath, that no person should be allowed ingress or egress without permission from the commissioners. Notwithstanding the confusion which this contest occasioned, Wolsey remained in ignorance of the tumult, until informed of it by a domestic, who chanced to see the proceeding from a small window, which, according to the fashion of ancient times, was placed so as to command a view of the hall. On receiving the intelligence which was thus communicated, Wolsey either affected to consider the arrival of the earl and knight as a visit, or really regretted, with the hospitality habitual to him, that he could not offer him a reception suitable to his rank. He ordered the table, at which he was seated, not to be removed, but to be replenished with such provisions as the castle afforded; and then advancing to meet the strangers, he encountered on the stairs the Earl of Northumberland, his former inmate, and pupil. Courteously chiding his guest that he had not apprised him of coming, Wolsey conducted Percy to his own apartment, that he might change his riding apparel; and there, Cavendish, the narrator of this interesting scene, alone accompanied them. The earl, confounded, perhaps, by the gracious manner and self-possession of the Cardinal, appeared unwilling to disclose the object of his commission to one whom he had been accustomed, from early habit, to fear, if not to reverence. At last, while standing with Wolsey by the chimney, he gained courage to say, in a faint and trembling voice, "My lord, I arrest you of high treason." It was some moments before Wolsey, astounded in his turn, could reply; but, recovering from his surprise, he demanded by what authority the earl acted; and refused to comply with his summons until he had seen his commission. Meanwhile, Sir William Walsh experienced a resistance equally resolute from Dr. Augustine, the Cardinal's domestic physician. He was thrust into the apartment at this critical moment by the enraged knight, who also made his appearance before Wolsey and the earl. On seeing Walsh, Wolsey made the same demand of his authority that he had urged to the earl; but Walsh, refusing to show his commission, to which he said some private instructions were annexed, Wolsey had not the satisfaction he demanded. He still declared, however, his objections to surrender to Percy, between whose ancestors, as wardens of the marches, and former archbishops of York, there had been, as the Cardinal alleged, old grievances, which might now actuate the representative of the house of Percy, to assert unwarrantable authority on this occasion. It is probable, that the humiliation of becoming the prisoner of one whom he had formerly governed, may have been the real

source of this reluctance. After this concession, Cavendish was commanded to leave the chamber; and the unhappy Wolsey, after consigning the keys of all his coffers to the commissioners, remained in his solitary apartment, closely guarded by the followers of Northumberland. The following day was passed in various arrangements of the household furniture, and of the personal property possessed by Wolsey. Cavendish alone was admitted to converse with him; and the narrative which he gives of their interview is extremely minute and affecting. The Cardinal, on seeing him, fell into a passion of tears, "which would have caused the flintiest heart to have relented and burst for sorrow." The sight of Cavendish, who had left his family and his home to serve him in his adverse fortunes, and the recollection of his other faithful attendants, was rendered grievous to the generous heart of Wolsey, by the reflection that they shared his ruin. The contrast between their attachment, and the malignant persecution of his high-born accusers; the dread of humiliation and of severity, aggravated by the change, from the deference of those around him, sunk the spirits of the Cardinal to the lowest state of depression. Yet, even at this time, he expressed confidence in the manifestation of his own innocence. "If I may come to my answer," said he, "I fear no man alive; for he liveth not that shall look upon this face, and shall be able to accuse me of any untruth; and that knoweth my enemies full well, which will be an occasion that I shall not have indifferent justice, but they will rather seek some sinister ways to destroy me." Notwithstanding this protestation, the anguish of Wolsey's heart could not be repressed, and despair began its ravages both on his mind and body, before he quitted his archiepiscopal palace. On the Sunday following his arrest, which happened on Friday, the Cardinal began his journey towards London, having been preceded by Dr. Augustine, who, with harshness and apparent injustice, was dispatched to the metropolis, fastened to the body of a horse, and under a strict guard.

Although prevented by Percy from taking leave of his domestics, Wolsey was followed by expressions of sorrow and attachment from many of his household, who forced their way into the apartment where he was, and fell on their knees before him. Throughout the town of Cawood, he was hailed with cries of commiseration, and of vengeance upon his enemies; and similar testimonies of the regard borne to him by the people were manifested during the whole of his progress to Doncaster. But neither these demonstrations of well-earned respect, nor the soothing and courteous reception of the Earl of Shrewsbury, could allay that fever of the mind which plainly showed itself in the countenance of Wolsey on his arrival at Sheffield Park, where he rested for eighteen days. To the watchful eyes of Cavendish, the illness which now attacked the Cardinal was obvious before he uttered any complaint; and it soon appeared so alarming, that it was judged expedient, even by Lord Percy, to use a greater degree of tenderness and caution than had hitherto been deemed necessary towards his afflicted prisoner. It was now requisite to apprise him that Sir William Kingston, constable of the Tower, was on his road to Sheffield Park, charged by the king to conduct Wolsey to London, there to make that defence which he so earnestly had desired to deliver in the face of his accusers. On hearing the name of Kingston, Wolsey was overcome with grief and consternation; for his mind, weakened by disease and calamity, reverted to a prophecy that he should end his days near Kingston; on which account, he had always avoided passing through the town of that name, situated near his former residence at Esher.

Surmounting the emotions to which this recollection gave rise, Wolsey was persuaded to receive Kingston, whom he saluted with his wonted courtesy, and from whom he heard the encouraging tidings of the king's favourable dispositions towards him, and kind messages of grace. It was then arranged that Wolsey should proceed with Kingston on the morrow, towards Leicester, the last resting-place of the unhappy Cardinal; but his illness increased so rapidly that he was unable to commence his journey so soon as he had intended. Even when he was considered well enough to depart, his illness was such that he could scarcely support himself upon his mule; yet he remained only one night at Hardwick-upon-Line, and another at Nottingham, and proceeded, notwithstanding increasing weakness, to Leicester, where he arrived at night. On reaching the abbey, his appointed abode, he was met at the

gates by the abbot and monks with torches, and received with great reverence. The first ejaculation of Wolsey, on greeting these holy persons, indicated his inward sense of his approaching death. "Father abbot," said he, "I am come hither to lay my bones among you;" and with much difficulty he was carried up stairs, and laid upon his death-bed, for he was now unable to walk, and his disease increased rapidly. Cavendish remitted not his last and sad attentions to his unfortunate master. After watching many hours by his bedside, the compassionate friend and attendant of Wolsey perceived that the object of his cares was likely soon to be released from his earthly troubles: yet the expiring light lingered in its socket, and the Cardinal continued to breathe until the following morning, when he seemed revived, asked for food, and confessed to one Dr. Palmes, who had for some time sedulously attended him. When this was finished, the morning was far advanced, and having, with the singular and unaccountable spirit of conjecture which is sometimes displayed by the dying, foretold the hour when his spirit should depart from its mortal tenement, he believed his end to be fast approaching. His words to Kingston, who bade him good morrow, were memorable and affecting. "I tarry," said he, "but the will and pleasure of God to render unto him my simple soul into his divine hands." He explained with great clearness the nature of his disease, which, in spite of some suspicions of his having taken poison, is credibly asserted to have been a dysentery, and alluding to the fatal tendency of that disorder; "Well, well, Master Kingston," said he, "I see the matter against me how it is framed; but if I had served God as diligently as I have done the king, he would not have given me over in my grey hairs." This remarkable and heartfelt reference to an existence spent upon the slippery ground of courts, in the pursuit of fallacious and unprofitable honours, affords an indication that, in his latter days at least, he had not suffered his understanding to be wholly perverted by the habits and associations of his life. After this acknowledgment, the second nature resumed the sway, and the dying Cardinal, again a courtier, besought Kingston to commend him to the king, and pressed him to remember all the communications which ever passed between them, especially touching the divorce. He manifested considerable anxiety with respect to the progress of the Lutherans, whose rapid increase in importance and estimation he dreaded as a zealous churchman. After a long address, which, as it has been transmitted to us, shows that the native energy of his mind remained with him to the last sigh, the unequivocal and awful symptoms of death appeared on his countenance. "And even with these words," says Cavendish, who received his parting breath, "he began to draw his speech at length, and his tongue to fail; his eyes being set in his head, whose sight failed him." Then the bystanders began to remind him of Christ's passion; the abbot was summoned to administer the fifth sacrament of the Roman Catholic church, called extreme unction; and the guard were also desired to witness his last moments. The superstitious notions of the age caused the spectators of the scene to regard as a circumstance of some moment, the coincidence of Wolsey's words with the hour of his death; he expired as the clock struck eight.

The character of Wolsey, obscured by the envy of his contemporaries, and by the resentment of the three sovereigns who succeeded Henry the Eighth, has received its due tribute of commendation in later times. He was a man enlightened far beyond the period in which he lived, and calculated to advance the progress of civilization with a rapidity inconceivable to inferior minds. The strength of his understanding was only equalled by the versatility of his talents. In each of the various spheres of action allotted to him, he effected some important and beneficial change; displaying, in his course, an originality in his conceptions, which overpowered the obstacles opposed by custom and prejudice. In his legislative and political functions, he generally laboured with assiduity to promote the order and prosperity of the realm; so that, had he never suffered his private interests to interfere with his public duties, and from his clerical habits suffered his discharge of those duties to be biassed by the spirit of his order, he would have been justly deemed one of the greatest statesmen his country ever produced. As a diplomatist, it were difficult to say whether his abilities or his industry were most remarkable. The object of his political measures was to preserve that balance of power, the notion of which he probably first infused into the mind of Henry: buti

those times, general principles were much more frequently sacrificed to the passions and interests of kings and ministers, than in the present day, when a system of action is adopted in our councils, and if often erroneous, has at least the advantage of being discussed, and the chance of being dispassionately pursued. In Wolsey's foreign transactions he displayed a degree of decision, accompanied with caution, which may probably have been acquired from his insight into the cabinet of Henry the Seventh; and to this he added a more extended knowledge of political economy than any preceding minister.* The league of 1518, concluded at Greenwich, under the administration of Wolsey, has been regarded as a model for all treaties for peace; and the dexterity, not unaccompanied by artifice, with which Wolsey managed the conference at Bruges, shows how great an adept he was in all the minor branches of the diplomatic art. Eclipsed as his fine qualities often were by a selfish ambition not rarely dashed with sordid propensities, they conferred on the commonweal benefits of no trivial value. To Wolsey England is indebted for the first notion of a vigorous police, and of a regular system in the administration of justice. To him she owes, in part, the superiority of her navy, to which Henry the Eighth, by his advice, directed a closer attention, treating it with a greater liberality than any of his predecessors had done. To Wolsey may be ascribed the first regular patronage of the medical art. In a more general sense, incalculable benefits may be traced to the example and encouragement given by his zeal and energy in promoting a spirit of improvement, and in rousing men from the slumber of ignorance and dull contentment in which all classes of society were at that time in some degree plunged.

In the ecclesiastical department, the merits of Wolsey are less unequivocal. It is true that he sought to promote the truest interests of the church in facilitating the means of education to its members, and enabling them to attain that sound knowledge without which power is both pernicious and unstable. But while he cherished this meritorious scheme, the immediate effects of his example were detrimental to his sacred profession, and to religion. Although his zeal did not run into acts of persecution, yet it was generally suspected to result from ambition, and to savour far more of desire for the papal chair than of affection for the tenets of the church. In morals he was more than loose, not merely tolerating the improprieties of others, but countenancing them by his own departure from decorum. Yet some allowances are to be made for the profligate manners of the times, and for the lax notions of the great body of the clergy in those days of professed celibacy. In promoting the diffusion of science and letters, Wolsey aided the cause of virtue, ever most secure when attended by those auxiliaries, and invigorated by their natural consequence, mental employment. Wolsey was sincere and enthusiastic in his love for learning, both biblical and classical. Indifferently educated and cast too soon into the business of life to make any great proficiency in literature himself, he is yet declared to have recalled into this country the "three learned languages, without which all learning is lame." He invited Erasmus, and other celebrated scholars to England, and selected his daily associates and his household from the same valuable class of persons.* Even before he had brought his designs regarding Oxford to maturity, he projected the establishment of seven additional lectures there, both for the promulgation of knowledge, and as a means of provision for the learned. His solicitude for the welfare of his infant college was manifested by affecting supplications to Henry for its continuance, after all his own worldly prospects seemed closed for ever.

In the personal character of Wolsey there is a mixture of magnanimity and meanness, of arrogance and of urbanity, which alternately excites contempt and admiration. For the display of qualities so opposite, his lowly origin and sudden elevation may, in some degree, account. His nature was generous and open, as the affection of his dependents testifies: but he became habitually haughty and overbearing from the assumption of a rank to which he had no claim by birth, and rapacious from the indulged desire to give to that rank the lustre of unwonted magnificence and parade. The greatest vice of his character was, that he knew not to forgive. An affront to his dignity, or a sarcasm upon his weaknesses, was keenly felt, and it was bitterly re-

* Herbert, p. 75.

* Strype's Ecclesiastical Memorials.

sented. The poet Shelton, tutor and poet laureate to Henry the Eighth, was pursued with unrelenting anger, for having indited satires upon the Cardinal, which were then deemed replete with poignancy; but in which the modern reader can with difficulty discover the sin of malice, through the veil of dulness. But Wolsey thought otherwise, or he regarded the design rather than the execution. The rash versifier died in the sanctuary of Westminster, whither he fled to escape the holy vengeance of this father of the church.

The more memorable fate of Buckingham was imputed to the wounded pride of Wolsey; and the early offence revenged upon Sir Amias Paulet evinced, that if, in some instances, the motives of his conduct were misconstrued, the unchristian spirit attributed to it too surely sullied his character.

Wolsey left one illegitimate son, Thomas Winter, who received, through the bounty of his father, a learned education at Paris; and, by the patronage of the Cardinal, was presented to eleven benefices.* Two other children were also said to have owed their being to the Cardinal, who was charged, in the articles of his impeachment, with having compelled Sir John Hanley to resign a farm belonging to the convent of Chester, in favour of the man that had married their mother. This statement is less certain than the other; nor is the point of any importance, except as illustrating his imperious and unscrupulous nature.

The remains of Wolsey were interred in the Abbey church of Leicester, after having been viewed by the mayor and corporation of Leicester, for the prevention of false rumours. On removing the body, it was found that he wore a shirt of haircloth next to his skin, an act of penance customary among the pious in those days; and, though indicating very false conceptions of the will of that Being who has constituted our frames for enjoyment, and who has beautifully exemplified the image of happiness in the infant state of man, this little circumstance, which was unknown to the attendants of Wolsey, proved that repentance and self-abasement were in his thoughts.

It was deemed proper that the Cardinal's corpse should be interred decorated with such vestures and ornaments as appertained to his holy offices. Thus, attended to the last by some semblance of human grandeur, all that remained of Thomas Wolsey was deposited in the grave by torch-light, between four and five o'clock of the morning of St. Andrew's day, November 30th, 1530; the abbot and all the convent attending in solemn order, the canons singing dirges, and offering orisons.

The king, upon hearing of the death of his former favourite, is said to have expressed poignant concern, and to have declared that he would rather have lost twenty thousand pounds than so valuable a man; yet his grief did not prevent the selfish monarch from interrogating Cavendish, who conveyed to him the tidings, with some anxiety, about a sum of fifteen hundred pounds due to him from Wolsey; nor could his regard for the memory of a distinguished subject induce him to give it the just and even accustomed honours. The Cardinal's college, the glory of Wolsey, was assigned to a new patron, the monarch himself; and his monument, prepared by his own orders, and designed by Benedetto, a famous Florentine sculptor, was seized by Henry, who left the tomb of his renowned minister destitute and obscure.

It is impossible to close the page of history on which we have been meditating, without marking a circumstance calculated to give the personal character of the bold, able, and unprincipled man, whose story lies before us, a kind of interest that, strictly speaking, belongs not to it,—we mean the contrast presented by his royal master. When, revolted by the Cardinal's unbearable haughtiness, or disgusted with his meanness, we turn to the king and find him clothed in all his minister's worst vices, and glaring with all his own, unredeemed by a single virtuous or amiable quality, we at once acknowledge that a more hateful tyrant has scarcely ever cursed any country whose sins he was suffered to chasten, and feel disposed to dwell upon Wolsey's talents as a mitigation of his faults. This feeling is softened into something like pity, when we reflect on the black ingratitude that worked his ruin; we are fain to admit that his fall was effected by almost the only hand which had no right to rise against him; and we retire with the impression, that no one portion of his character claims more of our reprehension than his unhesitating, undeviating subserviency to his imperious master.

* Fiddes, p. 531.

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KER, Charles Henry Bellenden

# SIR CHRISTOPHER WREN;

## WITH SOME GENERAL REMARKS ON THE ORIGIN AND PROGRESS OF ARCHITECTURE.

"ARCHITECTURE HAS ITS POLITICAL USE, PUBLIC BUILDINGS BEING THE ORNAMENT OF A COUNTRY; IT ESTABLISHES A NATION; DRAWS PEOPLE AND COMMERCE; MAKES THE PEOPLE LOVE THEIR NATIVE COUNTRY, WHICH PASSION IS THE ORIGIN OF ALL GREAT ACTIONS IN A COMMONWEALTH.

"IT AIMS AT ETERNITY; AND THEREFORE IS THE ONLY THING INCAPABLE OF MODES AND FASHIONS IN ITS PRINCIPLES (THE ORDERS,) WHICH ARE FOUNDED UPON THE EXPERIENCE OF ALL AGES, PROMOTED BY THE VAST TREASURES OF ALL THE GREAT MONARCHS, AND SKILL OF THE GREATEST ARTISTS AND GEOMETRICIANS, EVERY ONE EMULATING EACH OTHER; AND EXPERIMENTS IN THIS KIND, BEING GREATLY EXPENSIVE AND ERRORS INCORRIGIBLE, IS THE REASON THAT THE PRINCIPLES OF ARCHITECTURE ARE NOW RATHER THE STUDY OF ANTIQUITY THAN FANCY."—*Wren.*

### CHAPTER I.

*Of the Origin of Architecture and the different Styles, and the purposes to which they have been applied.*

WE shall preface the account of the life of Sir Christopher Wren, whose name is associated with all that is great in English architecture, with a few general observations on the rise and progress of the art, which will in some measure serve as an introduction to the Treatise on that subject intended to be published.

It is generally admitted that the early architecture of Greece was indebted to Egypt for some of its rudiments; and yet it is impossible to institute the most careless comparison, without observing the very different character displayed in the earliest specimens of Grecian art, and particularly in sculpture. The causes of this diversity it is difficult now to define, although every variety of speculation has been exhausted on the subject.

In all the advances of the art, the principles of the early attempts, which had their origin in necessity, appear to have been constantly adopted in the improvements of the succeeding ages: the dark and ponderous buildings of the Egyptians have a near affinity to the caverns of their ancestors; and the ornamental and elegant architecture of Greece bears striking testimony to the early use of the timber with which that country abounded. In India the original employment of reed and bamboo is discovered in the lofty and slender buildings of later times; in China the roofs are always constructed in imitation of the moveable tents of the aboriginal Tartars; and the same observation applies to Turkish and Saracenic buildings.

One of the peculiar features of Egyptian buildings is, that none of the specimens afford much evidence of variation, either in principle or in the constituent parts, during a very considerable period of time. Without entertaining great admiration for the beauty, the grandeur, or the simplicity of Egyptian structures, it is yet impossible to contemplate without wonder those immense and gloomy monuments of labour, in which, independently of situation and size, a very striking effect is produced by the peculiarity in the arrangement of the different parts, and by their vast groves of columns, obelisks, and colossal statues.

The external character of the Egyptian style is, however, in a great degree simple and imposing; the columns and decorations usually are internal, contrary to the Grecian architecture, in which the interior of the temples is comparatively plain, the columns, the statuary, and other ornaments being nearly all external. This may be traced, in some degree, to the difference of the climate.

In the contemplation of the Egyptian temples, their resemblance to the ancient buildings of India is peculiarly striking; and this naturally leads to the consideration of the discussions to which the early progress of ancient nations in architecture and some other arts has given rise.

In tracing the origin of the arts first practised by man in his progress from barbarism to civilisation, after those

necessary to insure his subsistence and clothing, that of providing shelter from the inclemency of the weather must have been the earliest cultivated. It has been frequently remarked, how soon man became acquainted with the means of fabricating cloth; architecture and weaving are amongst the first complicated arts practised by barbarians, and were even at an early period carried to considerable perfection: next to the care of necessaries, the love of ornaments arises in the breast of a savage; and the art of fetching out the brilliancy of the precious stones and metals is, accordingly, one of the earliest which are noted in the progress of a rude people.

Architecture, weaving, and jewellery are the only arts for which the *Hindoos* have been celebrated, and even these, with the exception of weaving, attained but a low degree of perfection. The ancient buildings of Hindostan have been at different periods the subject of wonder, and considered as evidencing a high civilisation: yet there are productions in China of dimensions and importance vying with them. "The Mexicans, ignorant of iron, cranes, and scaffolds, with neither carts nor sledges, and no means of working their stones but with flints, or of polishing them but by rubbing them against each other, accomplished works which in magnitude and symmetry rival any of which Hindostan can boast."

The Pyramids of Egypt, vast as are their dimensions, afford intrinsic evidence of the rudeness of the period at which they were reared. The sepulchre of *Belus* at Babylon, according to *Strabo*, was built of different bodies or stages one rising above another, exactly in the manner of the great Temple at Mexico, as is noticed by Humboldt, who also observed the resemblance between the Pyramids of Egypt and the vast Pyramids the remains of which are to be found in South America. The Palace of Montezuma strongly resembled that of the Emperor of China; and Knox, after remarking the passion of the Cingalese for constructing temples and monuments of enormous magnitude in honour of their Gods, observes, "as if they had been born solely to hew rocks and great stones, and lay them in heaps:" "the unsophisticated opinion," remarks Mr. Mill, "of a sound understanding on operations which the affectation of taste and antiquarian credulity have magnified into proofs of the highest civilisation."*

It is not intended to urge any arguments in detail as to the common origin of the buildings of India and the *Monolithic* (built of one rock) Temple of Egypt. The fact, however, that the Sepoys, in their march to join the army of Lord Hutchinson, conceived they had found their own temples in the ruins of *Dendyra*, is mentioned by Captain Light in his *Travels*, and so convinced were they of the identity, as actually to perform their devotions in them.

Monsieur Legrand, in his very interesting Essay on Architecture, attaches much higher value to Egyptian architecture than it deserves, describing it as "noble, severe, and imposing in the highest degree, and appearing still to resist the destroying hand of time after a lapse of four thousand years;" and he thinks that such ideas were not generated in the infancy of the art, as has been often imagined, but were "the fruits of a long continued civilisation, great knowledge, and a tending to lasting glory." "This elevated style," continues the author, rising with his subject, "which is not sufficiently understood, deserves to be profoundly studied in all its parts, and again adopted by those men whose aim is to astonish the present age, and to ensure the admiration of posterity." That Pyramids will be again built for the admiration of the present or of future ages is not to be feared; and it may be doubted, if Monsieur Legrand will by his eloquence conjure up a hardy spirit, who will undertake the task of handing down to posterity, at a vast expense, the dark and dreary monotony of the Egyptian Temples, at least not till we shall be again reduced to a state of society resembling that in which they lived who commanded them to rise, and till some king shall exist, "whose power being unlimited, is compelled to solace, by the erection of a Pyramid, the satiety of dominion, and tastelessness of pleasures, and the tediousness of declining life, by seeing

* *British India*, vol. i. p. 430.—The chapter of Mr. Mill, on the Arts of Hindostan, is particularly interesting, and contains a vast variety of curious matter, tending to show that the facts usually adduced as proofs of the early and complete state of civilisation amongst the Carnatic nations, do not establish the position contended for, and that Hindostan had not in fact made any greater progress in the arts than China, Mexico, or other nations still considered in a state of semi-barbarism.

thousands labour without good, and one stone for no purpose laid on another."

In considering the history and progress of art, its real importance to the happiness of mankind is a question which naturally occurs. If it be true that what are termed the fine arts are of the importance sometimes ascribed to them, their effects on the welfare of mankind may be expected to increase in proportion as they advanced towards perfection; and it is the opinion of some eminent writers, that they have not yet reached the utmost verge of excellence, and that we have still much to hope and to attain. To determine, however, this point, we must have some standard admitted to be just, some uncontroverted principles or axioms with which we can institute comparison, or by which we can measure our progress: taste is too indefinite for the purpose; it is claimed equally by persons who hold the most discordant opinions on the point, and whose repugnant pretensions rest upon the most opposite principles. Being incapable of transmission by very accurate rules of description, in practice taste frequently appears a term convertible with that of fancy.

Whatever doubts may exist as to the importance of the fine arts, the case is different with the sciences. In them, scarcely a discovery or an improvement is suggested but it becomes converted to the use of mankind: they leave no room for conjecture as to their merits, nor any hesitation as to their advance. The navigator, manufacturer, statesman, and philosopher concur in their opinions of their progress and effect; and our ameliorated condition affords the best testimony of their improvement. Whatever may be the comparative importance of the results flowing from these different branches of our knowledge, it is plain that they require at least the same general circumstances to favour their growth—exemption from the desolation of war, opulence to furnish rewards, and leisure to permit application: but, above all, a government should exist, in which the preponderating influence of the people forbids that a nation should be subject to the narrow views and interests which, with few exceptions, appear at all periods to have regulated the dominion of despotism. The suspicion natural to tyranny, and the dread that light or information should expose its deformity, makes it feelingly alive to the dangers resulting from all freedom of inquiry.

It is impossible, nevertheless, to consider the unrivalled excellence which the arts attained during the prosperity of some of the Italian republics, without being convinced of the prodigious effects sometimes produced on the energies of the human mind, by an exemption not merely from the restraint of absolute authority, but even from the languor and tameness often produced by very regular governments, though in effect calculated for the tranquillity and comfort of a people. The internal condition of these states was a perpetual struggle of faction amongst the citizens, a contest for power and popularity amongst the rich, a defective administration of the laws, and a doubtful state of private morals. The same observations may, in a great measure, be applied to some of the ancient Greek republics;—and yet amidst such scenes were reared the most finished monuments of art, precious indeed, but purchased at far too high a price, if the alternations of anarchy and misrule were necessary for their production.

Architecture, as an ornamental science, may be supposed to have kept pace with the art of design, the improvements in each depending nearly on the same vigour of imagination and general refinement of taste; and the same powerful cause, or combination of causes, which (in Greece) so early produced by the operations of genius such a magical effect on the arts of design, exerted a similar influence on the state of architecture.*

### *Grecian Architecture.*

From the contemplation of the solemn grandeur of the Egyptian monuments we proceed to the Greek temples, whose character is so different. Whilst struck with the size of the Egyptian buildings, we feel that they are the effect of incessant labour, the works of slaves, without much of the assistance of intellectual greatness, and that their importance arises chiefly from their extent. It is far otherwise with the works of Greece, where every line is expressive of the genius and imagination of the author; and, though great labour must have been exerted in their construction, yet the mind is relieved from all sense of pain by admiration of the result.

* *Introduct. to Trans. of Vitruvius.*

The Greeks being more lively in their manners than the Egyptians, and fonder of external show and processions, their temples exhibited a corresponding change; the front was adorned with a peristyle, sometimes double and even triple, as is seen in some of the remains in Sicily, Italy, Syria, &c.

The most perfect simplicity of form was united with the grandeur produced by the rows of columns: a low pediment crowned the façade for the purpose of receiving the slanting concealed roof; and the buildings were large and grand without partaking of the colossal appearance of the Egyptian. The interiors were unadorned, although at times some of the choicest specimens of sculpture were enshrined in them.

The simple grandeur of the Doric, bold without heaviness, rich without being overloaded with ornament, recording in its metopes all the eloquence of sculpture, and typical at once of the artless manners and bold deeds of the Greeks, was preferred by them during the best ages, to the Ionic and Corinthian, in all their great edifices. The Doric also had the peculiar advantage of being equally adapted to great and small edifices; to small, by the simplicity of the divisions and members; to large, by its bold proportions and the massiveness of the entablature.

The Romans followed the Greeks in the form of their temples, but added to their richness by the new and elegant orders with which they decorated them; they frequently substituted a stylobate (pedestal) in place of the steps which supported the Doric columns forming a continuous base, and preferred to this chaste and simple order the elegant and more refined Ionic and Corinthian; and even these they enriched to profusion, lengthening the pediment, and surrounding it by triumphal cars and statues of terra cotta and gilt bronze. The buildings themselves they surrounded by enclosures and colonnades.

### *The Orders of Architecture and Proportion.*

The origin of the orders of architecture is a subject which has given rise to much fruitless and absurd discussion. Every member of the different orders, every part of the columns and the entablatures, has a variety of origins assigned to it, and each supported by a variety of advocates. One idea which seems to have been very stoutly maintained, is the analogy between the proportions of the human figure and those of the orders; and so far is this idea carried by Michael Angelo, that he declares a knowledge of anatomy to be indispensable to an architect, who without it must be necessarily ignorant of his profession. It is certain, he observes, that the members of architecture have a reference to those of the human body; and he who does not understand the human figure, and particularly anatomy, can know nothing of the subject.

The intrinsic beauty of the Grecian orders has long been one of the dogmas of the connoisseurs. This has been, we think, completely exposed by Mr. Alison in his *Essay on Taste.* The true cause of this beauty may be reduced *to the propriety or fitness of the building for the end designed,* and nothing further: as, in plain buildings, and without any view to ornament, if the walls are of such a height as with our previous experience seems sufficient for their own stability, and for the support of the weight which is imposed on them, we consider the house to be rightly proportioned; whilst if the walls are so large as to appear insecure, or the roof so high as to seem too heavy for its support, the notion of ill proportion immediately occurs. This fitness, however, cannot be accurately measured, and, accordingly, no proportions are defined, and the general conclusions we have formed are our only guides.

But in what are termed the *Orders* of Architecture this is otherwise, and the proportions have been absolutely determined. They are five: the Tuscan, Doric, Ionic, Corinthian, and Composite. The first and last, however, are generally rejected. In considering the orders, it must be remembered, that the *proportion,* not the *ornament,* constitutes the order. Every order consists of three great divisions: the base, the column, and the entablature, or that part which is placed immediately above the capital of the column; and the governing proportions relate to this division, the whole in fact composing a wall, or what in common buildings would be the wall. Though the wall derives its proportion in an order, from the intention of supporting the roof, yet it is complete without the roof; and when there is one, it is generally so contrived as not to appear: the weight which is, or appears

to be supported, being the entablature: the fitness, therefore, here, consists in its appearing adequate to the support of the entablature:—" and the appearance of these proportions," observes Mr. Alison, "seems to lead us to this conclusion. Thus in the Tuscan, where the entablature is heavier than in the rest, the column and base are proportionably stronger; while in the Corinthian, where the entablature is lightest, the column and base are proportionably slighter: this position is confirmed by the general use of the term *proportion* in its general acceptation, which implies *fitness to the end designed*: heaviness and slightness are the terms more generally used to express a deviation on either side from the proper relation; both obviously including the consideration of support, and expressing the want of proportion. If our perception of the beauty of proportion were in such cases altogether independent of any such considerations, these circumstances in language could not possibly take place; and it would be as possible to explain the nature and beauty of proportion by terms expressive of sound or colour, as by terms expressive of fitness or propriety.

"That there is no absolute beauty in the proportions of the orders, independent of that arising from fitness, is obvious. Mankind, however, soon acquire ideas of bulk and support; and the feelings of persons in general, on viewing the proportions of an order, are to be considered rather as satisfaction than delight: that which creates the delight, is the magnificence, the grandeur, and the costliness, which such buildings usually display. This is well illustrated by conceiving the entablature as the weight to be supported; and, of course, a certain form and size in the column is demanded for this; and in the base, for the support of both. A plain stone, for instance, set upon its end, has no proportion further than for the purpose of stability; if it appears firm, it has all the proportions we desire, and its form may be varied in a thousand ways, without interfering with our sense of its proportion. Place a column, or any other weight, on this stone, immediately another proportion is demanded, namely, that which is the proportion adapted to support this weight; though the form supported has no proportion further than that which is necessary for its stability, or for continuing in its situation. Above this, again, place an additional body, and immediately the intermediate one demands a new proportion; *viz.* a proportion suited to the weight it supports; and the first part, or the base, demands also another proportion in consideration of the additional weight which is thus imposed upon it. On this supposition, it is obvious that the consideration of fitness alone leads us to expect a certain proportion in each of these parts, and the parts are pleasing or beautiful just as they answer this demand."

Mr. Alison, however, admits, that the mere consideration of fitness is insufficient to account for the pleasure so universally derived from the established orders, which have been so long adhered to without any attempt at deviation. This is justly to be attributed to other feelings unconnected with proportion, arising from the ornaments, the materials, and the size; and more particularly from the associations which arise on a contemplation of the *Grecian* orders; although we are inclined to attribute our admiration to the style of the architecture alone.

One of the objections which may be urged against these positions, is the fact, that notwithstanding there is no intrinsic beauty in the proportions of the orders, yet they have, for a long period, been adopted without any attempt at alteration, which would seem to indicate that they were intrinsically beautiful. But the feelings and motives which would in most other objects of art lead to a variation, do not exist with respect to architecture. Of all the fine arts, architecture is the most costly; and the wealth even of nations is equal only to slow and infrequent productions. The value of such objects is therefore, in a great measure, independent of fashion; the invention of men is little exerted to give an additional value to subjects, which in themselves are valuable; and the art itself, after having arrived at a certain necessary degree of perfection, remains in a great measure stationary, both from the infrequency of cases in which invention can be employed, and the little demand there is for its exercise.

In addition to the costliness of the production, we must consider its durability; since it is only those productions of which the materials are perishable, and require often to be renewed, that are subjected to the in-

fluence of variety. The works of architecture are designed to last, and do last for centuries: the life of man is of far less duration than such productions; and the present period of the world, though old with respect to those arts which are employed upon perishable subjects, may be considered as yet young in relation to an art which is employed upon such durable materials as those of architecture. Centuries must elapse before works of this class demand to be renewed. The sacredness of antiquity is acquired in the mean time, and a new motive given for the preservation of similar forms.—We have considered Mr. Alison's positions so true, and so important to the due consideration of the subject of the orders, that it has been necessary to give them at length.

In observing on the nature and effect of Grecian architecture, it is necessary to advert to a singular position of the learned writer of the Introduction to the translation, of Vitruvius, (Lord Aberdeen,) namely, that the ancients never possessed any knowledge or perception of those qualities of external objects which are called picturesque. The admirable positions of the Temple of Minerva, the approach (on the angle) to the Temple of Jupiter Olympius at Athens and Sunium, and many other examples, may, we think, be quoted as ample testimony that the ancients possessed a fine and just sentiment for the picturesque position and effect of these monuments, although they practised landscape painting very little, and the illusion of perspective was not much used by them in their compositions. The villa of Pliny, so elegant and so interesting in the description, and which has been considered as a proof of the opinion we have advanced, is viewed by the writer above noticed as not in truth affording any grounds for such an opinion: and he suggests, that if any external irregularity may be considered to have existed, it must have been purely accidental, and only produced in consequence of the necessary arrangement of the interior apartments, and without the least reference to any general or preconceived design.

With regard, however, to the private houses of the ancients in cities, there are but very few instances of much attention being paid to the exterior architectural design; and they were of slight construction. Those of Pompeii, as well as those designed in the various paintings found on the walls of that city, seem to prove that exterior architecture was not an object, and was generally sacrificed to that of the interior. The habits of domestic privacy of a people which required that the apartments should receive light and air only from an interior court or atrium, and the climate which made such a court desirable on account of its coolness, induced them to lavish the graces and expense of their architecture on the interior rather than the exterior of their houses. Julius Cæsar obtained a special decree to enable him to adorn the front of his house with a pediment: and Gibbon observes, that in the commonwealths of Athens and Rome the modes and simplicity of private houses announced the equal condition of freemen, whilst the sovereignty of the people was represented in the majestic edifices designed to the public use; every part of the empire was fitted with ample theatres, temples, porticoes, triumphal arches, baths, and aqueducts, all variously conducive to the health, the devotion, and the pleasures of the meanest subject.

### *Gothic Architecture.*

In the foregoing observations on the different styles, the Gothic has been omitted. Whatever may be its beauties, and whatever may be the feelings of admiration arising from association, there can be no question that the style is but little adapted to utility; and the expense of producing what might be considered as perfect specimens of this branch of the art, would alone in these days, in a great degree, preclude its revival. The style termed Gothic, (concerning the origin of which we shall not add to the number of discussions,) probably took its rise in the East; this hypothesis has been the most successfully supported by the fact of its appearing nearly at once throughout Christendom, and at a time when all the different states of Europe were attracted to the East by the Crusades; and it seems that the Goths had no share in the invention of the style which now bears their name, it being, in fact, a term of vituperation used by those who had introduced the restored Grecian. In Italy the term had its origin with

the school of Palladio, and in England with Inigo Jones and Wren.*

*Roman Architecture.*

The zenith of Roman architecture was under the auspices of Vespasian and his immediate successors, who completed the Temple of Peace and the Coliseum: upon the establishment of Christianity, external magnificence was sacrificed to internal decoration; and the oblong square, the ground plan peculiar to ancient temples, simple in the interior but magnificent in the external view, was gradually changed, as will be hereafter noticed, into the Greek and Latin cross, which are less favourable to beauty.

It was not, however, till about the time of Leo X. that architects were encouraged to apply to the antique models, and to measure their proportions, that the orders might be designed with precision. With Bramante, Sangallo, and Michael Angelo, the elegance of the Grecian and the splendour of the Roman architecture was revived, and St. Peter's was commenced. This may be considered as the period of the revival of architecture in Europe. After that, Rome became the grand school for architects; and they in general were content to form their taste, not as the great authors of the revival had, from works of antiquity, but from the new works which were then rising. It was not, however, till the time of Palladio that all the elegance and simplicity of the ancient buildings were rendered applicable to the practical purposes of domestic use.

*The different Epochs.*

On reviewing the progress of architecture, we find it marked by distinct epochs, which will, perhaps, admit of the following distribution. The *Assyrian*, of which, however, we have no definite knowledge, except its mention in scripture.—The *Egyptian* almost coeval with the Syrian, in which, however, a distinct style was adopted, marked by the building of Thebes, Dendyra, and the other principal monuments of Egypt.—The *Grecian*, (about the 7th to the 3rd century before Christ,) when the principal temples, including the Parthenon, the temples of Pæstum, Ægina, Corinth, &c. were constructed. — The *Roman*, in which the great aqueducts, bridges, and other public works were built, and in which the arch was brought into more efficient use, and gave rise to novel and infinite combinations and improvements in the art of building: the time of Hadrian may be fixed as the best period of this style.—The *first Christian* era, (Justinian,) in which the multiplied dome or cupola first came into general use; and this is important, as it was adopted for two reasons—to accommodate the large Christian congregations, and to distinguish their churches from the heathen temples, which the Iconoclasts held in detestation. — The *Saracenic*, which, without the colossal materials and mechanical means used by the Romans, first gave the idea of raising immense structures by smaller means. — And lastly, the *Cathedral* or second *Christian era* (thirteenth century) is remarkable for the vast sacred edifices which were erected throughout Europe, all partaking of the same general character.

It was during these several eras that the different great improvements were effected. As, in the *Assyrian*, the invention and completion of the brick.—In the *Egyptian*, the working of granite and marbles, and the use of them on an extended scale.—In the *Grecian*, the perfection of the beauty of proportion or fitness supplying the place of vastness and ponderous mass.—In the *Roman*, the arch, forming in fact the basis of the science, and admitting of the extension and adaptation of the principles of architecture to works which the Greeks could not have executed.—In the *first Christian* era, the dome perfected.—And in the *second* or *Gothic*, the pointed arch introduced, by which additional lightness and strength were attained.—These eras were dependent on the great religious changes in the history of Europe; were respectively marked by a different manner of construction; and (though separated by considerable intervals) formed the types for the productions during the intermediate periods.

*Of Architecture in England.*

The first appearance of the Italian school in England began with Holbein, (Hen. 8.) who was established here under

* This observation does not of course apply to the Saxon or Norman style with the circular instead of the pointed style, which was probably borrowed from the Roman and Byzantine schools, and hence not improperly termed *Romanesque.*

royal patronage, and gained sufficient influence for a partial introduction of the architecture which had begun to revive in Italy. The first house purely Italian is stated, by Mr. Dallaway, to have been built by Sir Horatio Palavicini; and although many magnificent houses were built in the reign of Elizabeth, they had lost all the beauty of the Gothic, without deriving any improvement from the dawning taste for the revived style. The ornaments, both within and without, were cumbrous, and equally void of grace and propriety:—nothing could exceed the heaviness of the cornices and ceilings wrought into compartments, or the awkward intersection of the passages; the hall retained nothing of the Gothic character, excepting its size and large bay window, and instead of battlements and pinnacles, the parapet was broken into numerous high misshapen pediments. Towards the end of the reign of James I. and the beginning of Charles's taste in architecture made a bold step from Italy to England at once, scarcely resting a moment to visit France by the way.

From the most profound ignorance in architecture, Inigo Jones (who had been sent to Italy either by Lord Pembroke or Lord Arundel) started up a prodigy of art, vying in some degree with his master, Palladio. The Banqueting-house at Whitehall, and the Church of St. Paul, Covent Garden, are sufficient proofs of his claim to be considered the founder of this style in England. But the civil wars put a stop to the course so happily begun. Wren, the next genius, arose to kindle afresh the love for that art which had been so long neglected. What had been begun by Jones was fully accomplished by Wren; and the period of our greatest architectural eminence was not far distant.

## Chapter II.

### *Wren's Birth, Education, and early Studies.*

Christopher Wren was born at East Knoyle, in Wiltshire, the rectory of his father, Dr. Christopher Wren, Dean of Windsor, on the 20th day of October, 1632. His father was a learned divine, descended from an ancient English family of Danish origin, and his mother was the daughter and heiress of Robert Cox, of Fonthill, in the county of Wilts.

Dr. Matthew Wren, his uncle, successively Bishop of Hereford, Norwich, and Ely, was a person eminent in the ecclesiastical history of England; who, having devoted himself to the royal cause, was impeached by order of the House of Commons in 1641, shortly after the impeachment of Archbishop Laud; but he was never brought to trial, though he suffered a protracted imprisonment of nearly twenty years: an injustice not singular in those troublous times. The *Parentalia*, a work we shall afterwards notice, contains a somewhat laboured defence of the bishop, meant to have been used had he been put on his trial. Right or wrong, he adhered firmly and unchangingly to the cause he had espoused, and to the memory of his royal master; and Cromwell, who often met Christopher (the subject of this memoir,) at his son-in-law Claypole's sent a message to the uncle, (by the nephew,) that he might come out of the Tower if he pleased; but the bishop utterly refused, disdaining the terms proposed for his enlargement; which were, as he conceived, a mean acknowledgment of Cromwell's favour and submission to his tyranny; determining, as he expresses it, to tarry the Lord's leisure, and owe his deliverance to him only. Whether Cromwell was informed of the terms with which his offers were rejected, is not known; but if he was, it does not appear to have altered for the worse the situation of the martyr to the cause of Royalty. The bishop, however, was mainly tinctured with the feelings of the times: he was conspicuous for his cruel persecution of the dissenters within his diocese; and he is represented as proceeding passionately against the Walloon manufacturers, who in the time of Edward VI. transplanted themselves into England and had their privileges enlarged, and were much encouraged by Elizabeth. He also makes a conspicuous figure in the virulent party squib, called "A nest of perfidious vipers in the parliament of black saints." From this it may be inferred, that his zeal for his own party carried him beyond reason, and exposed him to the severe animadversions of his enemies.—He had four sons, all of whom were eminent in their day; one being, at the Restoration, Secretary to Lord Clarendon, and afterwards to James, Duke of York; one was knighted, and the other two returned to Parliament.

Dr. Wren, the father of Sir Chris-

topher, was educated at Merchant Tailors' School; he became a fellow of St. John's, Oxford, Chaplain in Ordinary to Charles I., and was ultimately installed Dean of Windsor, and made Registrar of the Order of the Garter. His tastes and his habits led him to associate with all the learned of the age; and he possessed himself considerable attainments both in science and literature: he had turned his attention to the cultivation of that art, in the pursuit of which his son was afterwards to become so eminent; and it appears, from an estimate made by him, and preserved in the State Papers, that he had been employed by the court respecting a building to be erected for the Queen of Charles I.

Wren was one of those whose future eminence was early foreseen; and whose riper years redeemed the promise of youth. Like his great contemporary Pascal, his genius early displayed itself. But though alike in talents, their fates were dissimilar. The genius and acquirements of Wren laid the groundwork of his happiness through a long series of years, whilst in Pascal the acuteness of his intellect, and his acquirements, seem but to have aggravated his misery, and to have hurried him to an early grave. At the age of thirteen an invention by Wren of some new astronomical instrument is recorded, the account of which is dedicated by him to his father, in a Latin epistle. This essay was followed by others of the same kind. His infancy and youth were marked by a peculiarly delicate state of health; he received his early education at home under his father, and at the age of fourteen was sent to Wadham college, Oxford, where notwithstanding his youth, his attainments procured him the friendship and patronage of the most eminent persons, amongst whom were the ingenious Bishop Wilkins, and the celebrated Oughtred, who in the preface to his *Clavis Mathematica* mentions Wren as having attained, at the age of sixteen, such a knowledge in mathematics and other branches of natural philosophy, as gave promise of future eminence.—Wilkins also introduced him to Prince Charles, Elector Palatine, as a prodigy.

As early as the year 1645, Dr. Willis, an eminent mathematician, formed a sort of club of scientific persons, chiefly those connected with Gresham college, who met weekly; amongst them was Wren. Their object was the discussion of all subjects relating to philosophical inquiries, and from these meetings originated that body of eminent persons called the Royal Society, who by their pursuits contributed so mainly to the advancement of science. In 1648, Dr. Wilkins and several other leading members retired to Oxford, where they continued their weekly meetings, and thus set a fashion for the study of the useful sciences in that university. Amongst those distinguished persons were Sir W. Petty, the ancestor of the Lansdowne family, and Robert Boyle.

One of Wren's early inventions in the arts was a sort of *penna duplex*, for which he obtained a patent, and which gave rise to some controversy between Sir William Petty and himself; the former having taken out a patent for a similar invention on his return from France in the same year. Wren, more fortunate than his father and uncle, though he lived in troubled times, when the conflicting parties were exhausting themselves in acts of violence, pursued his course straight to the object of his ambition, in the study of those sciences which he was afterwards to adorn.

He is said to have been the first who turned his attention to the representation of subjects as shown in a microscope, and in which he was mainly assisted by Hooke; and Harrington, the author of the *Oceana*, alludes to these tastes, and also to the politics of the family, in some observations on a cousin of Wren's, whom he designates as being one of those *virtuosi*, "who had an excellent faculty for magnifying a louse and diminishing a commonwealth." Shortly after this he produced a Theory of the Planet Saturn, an Algebraic Treatise on the Julian Period, a tract much esteemed, it is said, by the most learned mathematicians of his day. In 1653 he was elected Fellow of his college, and soon proceeded to London, continuing to cultivate the sciences. One of the most important inventions of this period was the barometer; and to this some laid claim on behalf of Wren; but the discovery was, without doubt, the property of Torricelli, though it is supposed Wren was the first in England who suggested that the various weight of the atmosphere was the true cause of the variations in the height of the mercury, which the followers of Des Cartes had ascribed to the influence of the moon. Evelyn (himself a man of sense

and an ardent lover of learning, who studied all that was useful to his country, and was associated with the most eminent of his time) could not but often come in contact with Wren; and accordingly, in his amusing journal, he frequently bears testimony to his early excellence, calling him "that prodigious young scholar," "that miracle of youth," "rare and early prodigy of science."

Whilst Wren was devoted to the pursuits of science, the times were distracted by the fury of party. The objects of the early association of eminent persons at Oxford is thus described by Spratt, Bishop of Rochester, in his *History of the Royal Society:* "Their first purpose was no more than only the satisfaction of breathing a fresher air, and of conversing in quiet one with another, without being engaged in the passions and madness of that dismal age. And from the institution of that assembly it had been enough, if no other advantage had come but this, that by this means there was a race of young men provided against the next age, whose minds, receiving from them their first impressions of sober and generous knowledge, were invincibly armed against all the enchantments of enthusiasm. But what is more, I may venture to affirm, that it was in good measure by the influence which these gentlemen had over the rest, that the university itself, or at least any part of its discipline and order, was saved from ruin.

"Nor were the good effects of this conversation only confined to Oxford, but they have made themselves known by their printed works, both in our own and in the learned languages, which have much conduced to the fame of our nation *abroad,* and to the spreading profitable light at *home.*"

It was not until the age of Wren that the inductive process of Bacon was duly understood and appreciated. This period, on the eve of Newton's great discoveries, was perhaps the most important that has yet occurred in the annals of science. The spirit of inquiry, at first feeble, which actuated some individuals at the time of the revival of learning, had from numerous causes gathered strength, and spread itself over Europe. Bacon had turned his powerful and creative mind to the state of human knowledge, marking its imperfections and planning its improvements, amending the vagueness and uncertainty of physical speculations, and supplying the want of connection between the sciences and the arts. This and the illustration of Bacon's method by Galileo and his contemporaries, (amongst whom Wren was eminent,) first led the way to the general adoption of the new philosophy—reasoning gradually from particulars to those that were only one step more general; not as formerly, adopting general positions drawn suddenly from particular instances hastily assumed. It was now felt that facts and not opinions were the things to reason about, in order to arrive at the knowledge of the laws governing the material world; and Bacon himself had foreseen the formation of a society directed to scientific improvement, and has given a general outline of it in the *Nova Atlantis.* And it was now that the enthusiastic ardour in the pursuit of natural philosophy was awakened in the minds of literary men, and which has ever since remained undiminished. None of the members of these meetings were more conspicuous than Wren, who, together with Boyle, (the great improver of the air-pump,) had imbibed the true spirit of Bacon. They applied themselves to the prosecution of experimental science, being the avowed enemies of the philosophy of Aristotle; following up the true principles of the new philosophy by preparing a history of the phenomena of nature in all their modifications and varieties; and instituting every form of experiment for the sake of discovery. Wren was one of the first (in conjunction with Wallis, Huygens, Newton, Leibnitz, and the Bernouillis) to occupy himself with the investigation of the cycloid, which had been discovered by Pascal; and he constantly urged, in his communications to the Royal Society, the importance of experiments and observations on facts. "For the improvement of theories," he observes, "we need be least solicitous; it is a work which will insensibly grow on us if we be always doing something in experiment; and every one is more prone to exercise his fancy in building paper theories than patient first to pile the unsure foundation, and hew solid materials out of the history of nature: this is rather our task, and in many things we must be content to plant crab stocks for posterity to graft on; and instead of the vanity of prognosti-

cating, I could wish we would have the patience for some years of registering past times, which is the certain way of learning to prognosticate; experiment and reason is the only way of prophesying natural events; in combating prejudices, detecting error, and establishing truth."

This great era in the progress of useful knowledge was destined to conclude with the most splendid series of philosophical improvements yet recorded—the discovery by Newton, in succession, of fluxions, the composition of light, and the principle of universal gravitation, all within twenty years, and all the work of one individual!

During his residence at Oxford, Wren in anatomical science stood amongst the first professors of his day, and as early as the age of fifteen he was employed by Sir Charles Scarborough, an eminent physician and mathematician, as a demonstrating assistant. His abilities as a demonstrator, and his attainments in anatomy generally, are acknowledged by Dr. Willis, in his Treatise on the Brain, for which he made all the drawings; and he is allowed to have been the originator of the physiological experiment of injecting various liquors into the veins of living animals, which Bishop Spratt calls a "noble experiment," exhibited at the meetings at Oxford. A notice of it was sent into Germany, and published abroad, as is supposed by the treachery of Oldenburgh, a person connected with the men of science of that day; and who is believed often to have secretly communicated to the continental philosophers the discoveries which came to his knowledge, thus giving rise to numberless disputes and claims to priority of invention among the learned of that time.

This experiment is alluded to by Sir Christopher Wren himself, in a letter to a friend in Ireland, (conceived by Mr. Elmes to be Sir William Petty:) "The most considerable experiment I have made of late is this: I injected wine and ale into the mass of blood in a living dog, by a vein, in good quantities, till he became extremely drunk; but soon after voided it by urine. It will be too long to tell you the effects of opium, scammony, and other things which I have tried in this way. I am in further pursuit of the experiment, which I take to be of great concernment, and what will give great light to the theory and practice of physic." The French, however, laid claim to the discovery; but we shall not here enter into the controversy; the genius and the acknowledged and undisputed works of Wren enable him beyond all others to abandon his claim when it is contested.

## Chapter III.

### *Wren's pursuits to the Building of St. Paul's.*

Wren, in his twenty-fifth year, left his retirement at Oxford for the more extended field of the metropolis; being chosen, in 1657, to fill the Professor's chair of Astronomy at Gresham college. His inaugural Oration in Latin is published in Ward's *Lives of the Gresham Professors*, and its first sketch in English is to be found in the *Parentalia;* it is curious, as showing the care and labour which he thought it necessary to bestow on the work. This Oration at once established his reputation, and his Lectures were attended by the most eminent and learned persons of the time. The greater part of the Oxford Society, who afterwards were the leading members of the Royal Society, coming to London about 1658, usually assembled to hear Wren's Wednesday Lectures, in his Lecture room, and on Tuesday those upon, Geometry, by Rooke.

In his inaugural discourse, amongst other things, he proposed several methods by which to account for the shadows returning backwards ten degrees on the dial of King Ahaz, by the laws of nature. One subject of discussion was the Telescope, to the improvement of which he had greatly contributed. Another head comprised certain properties of the air and the barometer.

In 1658 Wren acquired fresh fame as a mathematician, by the solution of the celebrated problem of Pascal; which had been given out, under the assumed name of Jean de Mountfort, as a challenge to the learned of England; and, in return, he proposed another, for the solution of the mathematicians of France, which had formerly been proposed by Kepler, and solved by himself geometrically. The challenge, however, was never answered. In the same year he communicated four mathematical tracts to Dr. Wallis, the Savilian Professor at Oxford, which were published by the doctor in his Treatise on the Cycloid.

His method for the rectification of the cycloid was also produced by him this year; and he made a series of observations on the phases of the Planet Saturn, the results of which he disclosed in his Gresham Lectures.

His pursuits were alien to the fury of party or the politics of the day, and to this, and his connection with Claypole, it is probable he owed his escape from that persecution to which the other members of his family were exposed. The members of the Club, on the death of Cromwell, were scattered by the distractions which ensued, and the College itself became a quarter for soldiers.

Wren, who had fled from London to Oxford during the confusion, received the following letters from the Bishop of Rochester and his cousin; and as they are curious we shall give them at length.

Dear Sir,

This day I went to visit Gresham College, but found the place in such a nasty condition, so defiled, and the smell so infernal, that if you should come now to make use of your tube, it would be like Dives looking out of hell into heaven. Dr. Goddard, of all your colleagues, keeps possession, which he could never be able to do, had he not before prepared his nose for camp perfumes, by his voyage into Scotland, and had he not such excellent restoratives in his cellars. The soldiers by the violence which they put on the Muses' seats, have made themselves odious to all the ingenious world; and if we pass by their having undone the nation, this crime we shall never be able to forgive them; and as for what concerns you, they have now proved, that their pretensions to religion were all feigned, since by hindering your Lectures they have committed so manifest a sin against Heaven. Yet your many friends here hope you will hereafter recompense this unhappy leisure which is afforded you, by making those admirable discourses which you had intended for this place more public; and that you will imitate Cicero, who, being hindered pronouncing his Oration *pro Milone*, by the guards of Pompey's soldiers that encompassed his chair, set it forth afterwards more perfect than the rest.

His cousin Matthew, eldest son of Matthew, Bishop of Ely, also wrote to him from London at the same time, and on the same account, the following letter, which admirably depicts his own feelings and the state of the capital.

Dear Cousin,

Yesterday being the first of the term, I resolved to make an experiment, whether Dr. Horton entertained the new auditory of Gresham with any Lecture; for I took it for granted, that if his divinity could be spared, your mathematics would not be expected. But at the gate I was stopped by a man with a gun, who told me there was no admission on that account, the college being reformed into a garrison. Then, changing my pretension, I scarce got permission to go into Dr. Goddard, who gave me assurance enough, that none of your colleagues intended to appear this term, unless the soldiers be removed, of which there is no probability. Upon these premises, it is the conclusion of all your friends, that you may save that journey hither, unless some other occasion calls you; and for these I expect you will make me your agent, if they be such as I am capable of despatching. But it will not be amiss to take from hence the occasion of a short and civil letter to the Committee, signifying that you hope you have not deceived their expectations in choosing you, and that you are ready to attend to your duty but for this public interruption and exclusion from your chamber; or what else you will that looks towards this. I know no more domestic news, than what every body talks of. Yesterday I was in Westminster-Hall, and saw only Kendigate and Windham in the two courts, and Wild and Parker in the Exchequer; in the chancery none at all; for Bradshaw keeps the Seal as if it were to be carried before him in the other world, whither he is going. Glyn and Fountain pleaded at the bar. They talk much of the mediation of the two crowns, and proceed so far as to name Marshall Clerambault for the Ambassador, who is come hither from France.—My service to all my friends.

Soon after the return of Charles II., Wren was chosen to fill the Savilian professor's chair at Oxford, then one of the highest distinctions which could be conferred on a scientific person. The Restoration, which began with such favourable auspices, was mainly conducive to the foundation of the Royal Society, in which Cowley, the poet, bore a principal part; planning a society, which should have the disposal of considerable funds, for the encouragement of knowledge, and not forgetting the important work of the instruction of youth. The object of the society cannot be better expressed than in the words of Spratt, its earliest and eloquent historian.

"The purpose of its founders was to make faithful records of all the works of nature and art which can come within their reach; so that the present age and posterity may be able to put a mark on the errors which have been strengthened by long prescription; to restore the truths that have lain neglected; to push on those that are already known to more various uses; to make the way more passable to what remains unrevealed. This is the compass of their design. And to accomplish this, they have endeavoured to separate the knowledge of nature from the colours of rhetoric, the devices of fancy, or the delightful deceit of fables. They have laboured," continues this learned prelate, "to enlarge it, from being confined to the custody of a few, or from servitude to private interests. They have striven to preserve it from being overpressed by a confused heap of vain and useless particulars; or from being straitened and bounded up too much by general doctrines. They have tried to put it into a condition of perpetually increasing, by settling an inviolable correspondence

between the hand and the brain. They have studied to make it not only an enterprise of one season, or of some lucky opportunity; but a business of time, a steady, a lasting, a popular, an uninterrupted work. They have attempted to free it from the artifice and humour and passions of sects; to render it an instrument whereby mankind may obtain a dominion of things, and not only over one another's judgments. And, lastly, they have begun to establish these reformations in philosophy, not so much by any solemnity of laws, or ostentation of ceremonies, as by *solid practice and examples;* not a glorious pomp of words, but by the silent, effectual, and unanswerable arguments of real productions. As for what belongs to the members themselves that are to constitute the society, it is to be noted, that they have freely admitted men of different religions, countries, and professions of life. This they were obliged to do, or else they would come far short of the largeness of their own declarations. For they openly profess, not to lay the foundation of an English, Scotch, Irish, Popish, or Protestant philosophy, but a *philosophy of mankind.*"

We have been thus minute in setting forth the origin of the Royal Society, as being one of the most important institutions of the country, founded on the purest and the best principles for the attainment of its great object.

It may be permitted here to remark, that this society (so long eminent in Europe) has, in a great measure, become more aristocratic than formerly in the selection of its members; for, in Charles's time, on an intelligent citizen of London being proposed at the recommendation of the king, he told them, *if they found any more such tradesmen they should be sure to admit them all*

Wren about this time discovered a method for the calculation of solar eclipses, which was published by Flamstead in his doctrine of the sphere, and which was followed for many years as the most concise and plain. The Annals of the Royal Society also bear the amplest testimony to his knowledge and industry, in his commentaries on almost every subject connected with the abstruse sciences and the arts of life; and, in conjunction with Boyle, Hooke, and Wilkins, he originated many of the most important experiments of the day.

Amongst his communications was a History of the Seasons, as to temperature, weather, productions, diseases. For illustrating this subject he devised many curious machines, several of which kept their own registers, tracing out the lines of variation so that a person might know what changes the weather had undergone during his absence; and these contrivances he applied to wind-gages, thermometers, barometers, hygrometers.

He made great additions to the recent discoveries on pendulums; and referred to what has been since perfected, the making the pendulum a natural standard for measure.

He also originated many ways of making astronomical observations easy and accurate; and added much to the theory of dioptrics. He made constant observations on Saturn, and gave a true theory of that planet, before the printed discourse on the subject by Huygens appeared. He made maps of the Pleiades and other stars; and proposed methods to determine the great question as to the earth's motion or rest, by the small stars about the pole, to be seen in large telescopes. And he effected many improvements in the theory of navigation.*

Amongst his discoveries in the arts there appears great ground to suppose, that it was he and not Prince Rupert who first invented the art of engraving in Mezzotinto, though it was subsequently much advanced by the Prince; who did not, however, bear any ill-will towards his rival; for it appears from the *Parentalia*, that Wren was enrolled in the list of his especial friends, to whom that distinguished personage sent a yearly present of his choicest wine, from his vineyard on the Rhine.

He also, from the years 1660 to 1720, employed himself in a series of papers on the longitude. To enter into a detail of all the studies and discoveries of Wren would, in fact, be to give the whole history of natural philosophy in his age. Many of his inventions are lost; for it will be observed, that he himself printed nothing: many were secretly sent abroad, and appropriated by others not unwilling to appear in borrowed feathers. Wren himself observes, in one of his letters, "I must confess I have often had the pusillanimity rather to neglect that right I ought

* Hutton, *Mathemat. Dict.* &c.

in justice to have vindicated, than, by challenging it too late, incur the jealousy of being a plagiary."

Whilst at Oxford he was employed by the king to make drawings of the animalcula seen by a microscope, as we have before noticed; and a model of the lunar globe as seen by the best telescope of the times, was constructed by him, representing the spots and various degrees of whiteness on the moon's surface, with the hills, eminences, and cavities; the whole contrived so that by turning it round to the light it showed all the lunar phases, with the various appearances that arise from the shadows of the mountains and valleys. This was afterwards placed in the king's cabinet.

Nor were the Muses neglected by Wren; his pursuits in this kind are alluded to by his correspondent the Bishop of Rochester, who compliments him on some translations of Horace, observing: "You have admirably well hit his genius, your verse is harmonious, your philosophy very instructive for life, your liberty in translating enough to make it seem to be an English original, and yet not so much but that the mind of the author is still religiously observed." Not much faith is to be given to the encomiums of friends in literary confidences, but from this it may fairly be inferred, that Wren must have at least surpassed mediocrity.

In 1662 his *Prelectiones Astronomicæ* were published at the Oxford press. Dr. Isaac Barrow, who succeeded Rooke as professor of geometry at Gresham College, in his inaugural address, pronounces a very elegant encomium upon the merits of Wren, into which he enters largely; describing him as being one of the earliest promise, and the fullest performance, of any genius of his time.

In 1675, the Bishop of Rochester dedicated to Wren his observations on Mons. de Sorbiere's *Voyage to England;* and Hooke, in the preface to his *Micrographia*, states, that although he was at first induced to undertake the work at the suggestion of Bishop Wilkins, yet he commenced it with reluctance, because he had to follow the footsteps of so eminent a person as Dr. Wren, who was the first that attempted any thing of this nature, and whose original draughts make one of the ornaments of the great collection of rarities in the king's closet; adding, "I must affirm of him, that since the time of Archimedes there scarce ever met in one man so great a perfection, such a mechanical head, and so philosophical a mind."—He is also noticed with great honour by Newton in his *Principia*, in conjunction with Wallis and Huygens, as among the first mathematicians of the age.

Perhaps the whole history of literary and scientific men does not afford an example of one held in more high and general estimation than this highly gifted individual. His contemporaries appear willing and eager to testify both their admiration of his genius, and their esteem for that unreservedness and candour which prevailed throughout his intercourse with his associates. The history of his career is stained by none of those bickerings, those paltry struggles for priority or fame, so frequent in the lives of others of his time, who were as conspicuous for the weakness of their feelings as for the greatness of their minds. None of their bad passions appear ever to have darkened Wren's thoughts, or disturbed the even tenour of his course, directed as it was to the advancement of his favourite art, and the attainment of all that was useful in science. Neither could he be said to be afflicted with the credulity or vain pretensions which marked many of those who lived in the same age.

In 1665 he went to Paris, for the purpose of studying all the principal buildings, and the various inventions in the different branches of mechanics. From thence he intended to pass on into Italy, for the purpose of studying Vitruvius amidst the great remains of antiquity. While at Paris the Louvre was in progress, 1000 hands being daily employed on the works: some in laying its mighty foundations; some in raising the different columns and entablatures, composed of vast stones, by great and useful engines; others in carving, inlaying marbles, plastering, painting, gilding, which altogether formed, in the opinion of Wren, a school of architecture the best at that day in Europe. It was here he saw those great masters of the art, Bernini and Mansard. His few observations on the buildings of France have a peculiar relish and interest. "Fontainbleau (he remarks in one of his letters) has a stately wildness, and vastness, suitable to the desert in which it stands; the antique mass of the

Castle of St. Germain's, and the hanging gardens are delightfully surprising, (I mean to any man of judgment,) for the pleasures below vanish away in the breath that is spent in ascending.—The Palace, or if you please to call it, the Cabinet of Versailles, called me twice to see it; the mixture of brick and stone, blue tile and gold, make it look like a rich livery. Not an inch within but is crowded with little curiosities of ornament. The women, as they make here the language and the fashions, and meddle with politics and philosophy, so they sway also in architecture; works of filigree, and little trinkets, are in great vogue, but building ought certainly to have the attribute of *eternal*, and therefore to be the only thing incapable of new fashions."*

After enumerating many other buildings, he adds, " all of which I have surveyed, and that I might not lose the impression of them I shall bring you almost all France on paper, which I have found by some or other ready designed, and on which I have spent both labour and some money. Bernini's design of the Louvre I would have given my skin for; but the old reserved Italian gave me but a few minutes' view. It was a fine little draught on five pieces of paper, for which he had received as many thousand pistoles. I had only time to copy it out by fancy and memory, and I shall be able, by discourse and a crayon, to give you a tolerable account of it." In one of his letters he notices having on the anvil, " Observations on the present state of architecture, arts, and manufactures in France," which, however, unfortunately were never completed.

Wren returned in the beginning of 1666, and it does not appear that he carried into execution his project of visiting Italy.

Soon after the restoration, Charles II. contemplated the repair of the Cathedral of St. Paul's, which had become dilapidated during the commonwealth; its revenues having been confiscated, and the choir converted into horse barracks by Cromwell. In 1660 a commission was issued (in which Wren was named) to superintend the restoration. He was long employed in considering the best mode of effecting this. The cathedral had been partly repaired by Inigo Jones, by the addition of a beautiful Corinthian portico at the west end, not however in character with the style of the building. Wren proposed to rebuild the steeple with a cupola; a form of Church building, Evelyn observes, not then known in England, but which was of wonderful grace. This project was at once defeated by the desolating fire of 1666, which, destroying the greater part of the city, so injured the cathedral as to make its restoration impossible; and to this the scaffolding, which had been put up for the repairs, mainly contributed.

Evelyn alludes to the attempt to repair St. Paul's, in his dedication to Wren of his *Account of Architects and Architecture*. " I have named St. Paul's, and truly not without admiration as oft as I recall to mind, as I frequently do, the sad and deplorable condition it was in: when, after it had been made a stable for horses, and a den of thieves, you, with other gentlemen and myself were by the late King Charles named to survey the dilapidations, and made report to His Majesty in order to a speedy reparation; you will not, as I am sure, forget the struggle we had with some who were for patching it up any how, so the steeple might stand instead of new building; when, to put an end to the contest, five days after, that dreadful conflagration happened, out of whose ashes this phœnix is arisen, and was by providence designed for you."

That which produced so much individual misery, afforded (as Sir Richard Steele observes) the greatest occasion that ever builder had to render his name immortal, and his person venerable. A whole city at once laid waste was an opportunity for the display of inventive genius, which had never before been given to any architect; but the selfishness of individuals, their disputes, and intrigues, and conflicting interests, prevented Wren from carrying his great design for the restoration of the metropolis into effect. And though many of the narrow lanes and confined spaces of

* Never, perhaps, was so complete a failure as the mass of incongruities at Versailles, and never such a profuse squandering of treasure and even of life. Dulaure, in his "History of Paris," states the expenses (including the moving of hills, and the various other projects) at the incredible sum of forty-eight millions sterling; from twenty-two to thirty-six thousand labourers were constantly employed on the works. A camp was formed for the workmen near the spot, the limits of which were strictly guarded; and it was criminal even to notice the vast waste of life in the soldiers employed, 10,000 of whom are said to have fallen victims to excess of fatigue, and to an epidemic disease caused by the exhalations from the swampy ground.

the old city were removed, still none of his views were adopted. As soon as the fire was subdued, whilst the ashes were yet alive, he was on the ground, considering his plan for the restoration of the city. He proposed one main street from Aldgate to Temple Bar, in the middle of which was to have been a large square capable of containing the new church of St. Paul, with a proper distance for the view all round; the parish churches were to be rebuilt so as to be seen at the end of every vista of houses, and dispersed at sufficient distances from each other; four piazzas were designed at proper distances; and lastly, the houses were to be uniform, surrounded by arcades, like those in Covent Garden; while by the waterside a large quay was to run, along which were to be ranged the halls belonging to the several companies, with warehouses and other appropriate mercantile buildings. If such a plan (modified in some degree) had been effected, London, it must be confessed, would have far exceeded every capital in the world. It may, however, be doubted, whether the climate of this country is suited to covered arcades; and with respect to the complete regularity and uniformity of the streets, although in theory this is captivating, in execution its effect is dull and disappointing. The total want of interest and variety in those towns where it has been adopted, such as Carlsrhue, Darmstadt, and Manheim, to which we may add the New Town of Edinburgh, affords sufficient evidence in support of this position.

London experienced an unexampled series of calamities. First harassed by the civil war; next desolated by the plague; after this oppressed by the exactions of the unsuccessful war of Charles; and last ravaged by the dreadful fire, which laid the whole city in ashes. But with all this, the courage and the spirit of the people were not borne down; and with one heart and one mind, in the very reeking ruins, the restoration of the city, with increased grandeur, was undertaken. It is difficult to refrain from entering at length into the details of this dreadful calamity, particularly when there are such materials as the lively pen of Evelyn (an eye-witness) affords; but it is impossible not to note the magnanimity of the people, as described by the Bishop of Rochester, a writer far too courtly to attribute any very exaggerated merit to the humbler classes of society. He describes them "as enduring this, the second calamity, with undaunted firmness of mind; their example," he says, "may incline us to believe that not only the best natural, but the best moral philosophy too, may be learned from the shops of mechanics. It was indeed admirable to behold with what constancy the meanest artificers saw all the labour of their lives, and the support of their families, devoured in an instant. They beheld the ashes of their houses, and gates, and temples, without the least expression of pusillanimity. If philosophers had done this, it had well become their profession of wisdom; if gentlemen, the nobleness of their breeding and blood would have required it; but that such greatness of heart should be found amongst the *poor artisans and the obscure multitude* is, no doubt, one of the most honourable events which ever happened." —The Bishop's habits and prejudices led him to be surprised at finding greatness and forbearance amongst the lower orders of a free and independent people. If he had not learnt better from history, the subsequent struggles of those very persons, under the still greater calamities induced by the oppression of the Stuarts, would have afforded him new ground for admiration.

Charles, during his residence abroad, had imbibed a taste for the arts, particularly for architecture, and amidst his sensualities and misgovernment was not unmindful of their advancement. Upon his deciding to repair St. Paul's, to reinstate Windsor Castle, and to build a new palace at Greenwich, Wren (who to his other attainments added a considerable knowledge of architecture) was sent for from Oxford in 1661, to assist Sir John Denham, the new surveyor general. In the same year he took the degree of doctor of laws.

Denham was a partisan of the court in the troublesome times of Charles I., and was rewarded by his master with a grant in reversion of the place of Surveyor General of the Board of Works, to take effect on the death of Inigo Jones. As a poet and as a loyalist his merits are admitted; but his reward might have been more judiciously selected, for he was entirely ignorant of architecture. "It would have been ungrateful in the

king, on his restoration," observes Mr. Elmes, with great simplicity, " to have discharged Denham, and unsafe to have intrusted him with the execution of any great work." Few men, it must be admitted, could so ill afford to add to the list of their acts of ingratitude towards their followers and dependants as Charles: Denham remained surveyor with the salary, Wren was appointed his deputy,—and performed all the duties of the office. Although appointed, he held the place for some time before he received any important public employment; and the Infanta of Portugal having brought the expensive dowry of Tangier, it was proposed to Wren, on account of his knowledge in geometry, to proceed there to survey and direct the works at the mole, harbour, and fortifications: this, however, he wisely declined.

During his progress in making plans for the repair of the Cathedral, the state and condition of which he appears very minutely to have ascertained, he was employed to give a design for the erection of the new theatre (Sheldonian) at Oxford, the principal merit of which is in the scientific construction of the flat roof, which is 80 by 70 feet without any arched work or pillars to support it, and is said never to have been surpassed. Plott, who in his history of Oxford has given a detailed description of it, calls Wren the English Vitruvius. Cambridge also was not slow to require his services, and his first commission was for a design for the new chapel of Pembroke Hall, of which his uncle had been a liberal benefactor. The celebrated library of Trinity College was also one of his early works.

## Chapter IV.

### *On the form of the early Churches.*

Before we enter on the subject of the erection of St. Paul's, confessedly the second of the cathedral edifices in Europe, it will not, we conceive, be out of place shortly to trace the origin of the present form of Christian Churches from the simple plans of the Temples of antiquity. Those of the Egyptians and Greeks were in the figure of a parallelogram again divided into squares or other parallelograms; and it probably was not till the Pantheon at Rome was erected, that the Grecian Tholos or circular temple was attempted on so great a scale. The religious rites of the Greeks and Romans were all performed in the open air, either in the front of their temples, or in the midst of the city; the early Christians, on the contrary, persecuted on all sides, sought refuge in caverns and catacombs hid from the light of day, for the solemnization of the rites of their religion, until encouraged and protected by Constantine they first began to assemble openly in congregations, and to worship without fear.

The largest of the ancient enclosed buildings were the halls of Justice called *Basilicæ*, or Royal Houses; it is supposed by some, that these were first appropriated by Constantine to the use of the Christian congregations, and being closed on all sides protected them from the fanaticism of their persecutors. The early Christian Churches were constructed on the model of these, and, up to the present period, have in some examples retained their name. The original form of an ancient temple was an oblong *cella*, or chamber surrounded with porticoes, or where the side porticoes were omitted there was always one in the front; but in the basilica the porticoes were internal, there being no exterior portico or colonnade; and the interior was divided by rows of columns either into three or five divisions. (*Fig.* 1. and 2.) In the centre

*Fig.* 1.

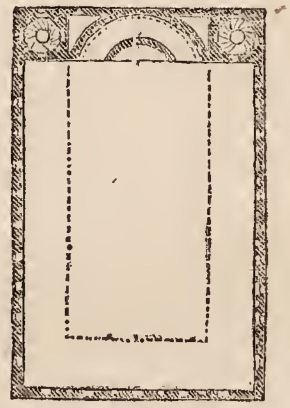
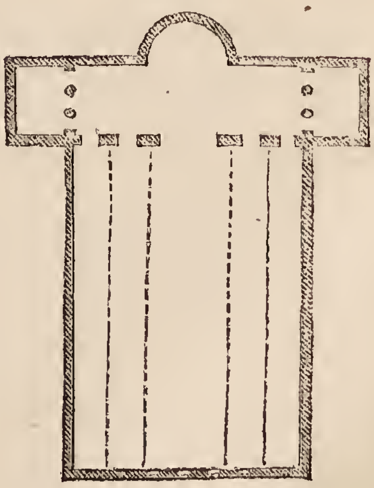


*Fig.* 2.



division (*fig*. 1.) the judge administered the law; and the side aisles, or porticoes, were occupied by the merchants and traders.

The first Christian Basilicas are referred to Constantine, and about the year 324 he erected the grand one of St. Peter's. It was divided into five aisles, running from east to west, and was terminated at the end by another aisle, or transept, from north to south, in the centre of which was a large semicircular niche, giving to the building an imperfect form of a cross, which he especially directed, as a memorial of that miraculous one which he had witnessed before his victory over Maxentius. The large aisle was enclosed by forty-eight columns of precious marble, and the side aisles had forty-eight columns of smaller dimensions: the whole was covered with a flat ceiling composed of immense beams cased with gilt metal, and Corinthian brass taken from the temples of Romulus and Jupiter Capitolinus. A hundred smaller columns ornamented the shrines and chapels; the walls were covered with paintings of religious subjects; and the tribunal, or niche at the end, was enriched with elaborate Mosaics or inlaid marbles. A vast number of lamps illuminated the temple; in the greater solemnities 2400 were reckoned, and 1360 of these were contained in an enormous candelabrum. It was on the site of this magnificent temple, which, falling into ruins, was pulled down by Julius II., that the present Basilica of St. Peter's was erected. In this sort of building the intersection of the aisles and the transept produced a centre which it was natural to enlarge and make the principal in the composition; this and the form of the Cross (the emblem of Christianity) were the cause of the deviations from the ancient form of the Basilica; and the invention of domes supported on pendentives added a size and dignity to the centre, without interrupting the vista of the aisles.

The disposition of the ancient St. Peter's at Rome was followed by Constantine in the church which he erected in his new capital of Constantinople. This being destroyed, Justinian employed Anthemius and Isodorus to erect a magnificent temple that should immortalize his name, and in this they first ventured on the novel construction of adding a dome, remarkable for its diameter and flatness, over the centre. The plan of this Basilica is a square of about two hundred and fifty feet; the interior forms a Greek cross, *i. e.* one with equal arms: the aisles are terminated at two ends by semicircles, and at the other two by square recesses: the aisles are vaulted, and the centre (where the aisles and transept intersect) forms the large square on which is raised the dome, of about one hundred and ten feet in diameter. The dome is supported on the four arches and the pendentives, or spandrils, which connect the square plan of the arches, and gradually form a circle at the level of their summit.

In consequence of the true principles of this mode of building not being discovered, the architects fell into many difficulties, and it was only after experiencing several failures, among them the falling of half the dome, and adding strong buttresses, that they were enabled to accomplish the glory of this magnificent design. These difficulties were, however, obviated in the building of St. Peter's, as in the dome and cone of St. Paul's, by adopting a much larger segment of a circle, and by inserting strong chains in the stone work at the base of the dome immediately over the arches, so as to give the lateral pressure a perpendicular bearing.

On the revival of the arts, this Basilica, the most magnificent and the last of the Lower Empire, was that which most influenced the form and character of the new temples. The Venetians in the tenth century copied with success the best parts of the disposition of Santa Sophia in the church of St. Mark, (now destroyed;) and it was probably the first of any extent which in Italy was constructed with a dome supported on pendentives or spandrils, and which gave the idea imitated in St. Peter's, of accompanying the great dome of a church with smaller and lower domes, to give a pyramidal effect to the whole. The church of Santa Maria del Fiore at Florence, from the magnitude of its dome, and the skill which Brunelleschi displayed in its construction,* acquired a celebrity that made the system of domes prevalent, till it was finally established in the church of St. Peter's, the grand type of all others. It was in the beginning of the sixteenth century that Bramante formed the magnificent design of suspending over the centre of the Basilica a circular temple

* See *Vasari's Life of Brunelleschi.*

as large as the Pantheon;—raising, as he expressed it, the Pantheon on the Temple of Peace; and in the completion of this great work, Michael Angelo was occupied till his death.

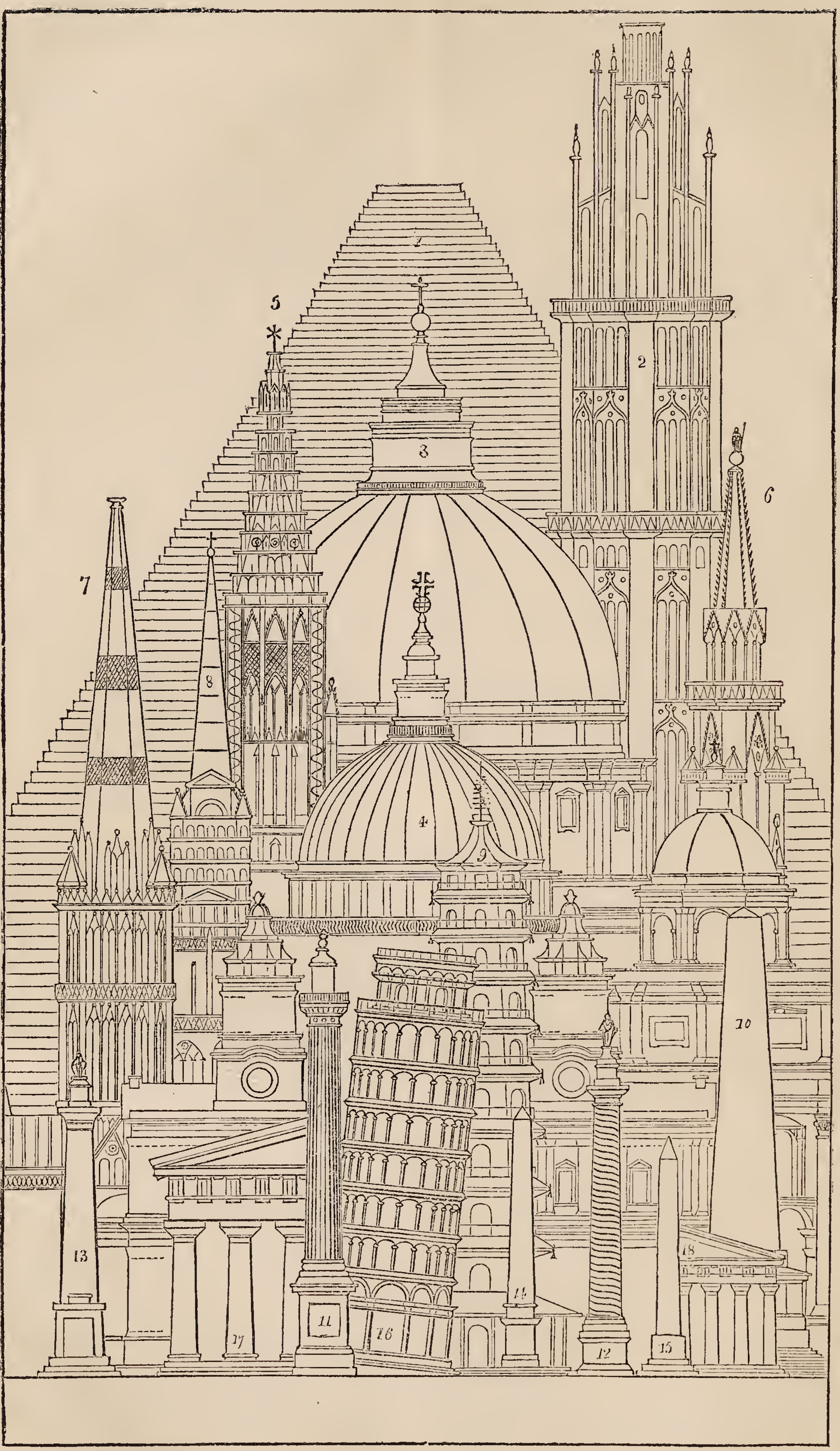
## Chapter V.

### *St. Paul's.*

After the nomination of the commission for the building St. Paul's, much discussion arose as to the plan. Wren's first design was to have but one order instead of two, and without any side oratories or aisles, these being only necessary for the ceremonies of the church of Rome: and this noble design appears in the beautiful model made by Wren, and kept in the present cathedral. The side aisles, however, were added either because their omission was considered too great a departure from the usual form of cathedrals, or (as is supposed by Mr. Spence in his anecdotes) because the suggestion of the Duke of York (James II.) was followed, and he was willing to have them ready for the Roman catholic service as soon as an occasion should arise. The addition of the side aisles is to be lamented, as they narrowed the building and broke in upon the beauty of the design; and the architect (observes Spence) insisted so strongly on the prejudice they were to the building, that he actually shed tears on speaking of it; but he remonstrated in vain. It would seem that this sort of interference is a misfortune peculiarly incidental to architects. Few would pretend to have a voice in the composition of a picture or the arrangement of a group of statuary; yet there is scarcely the work of any great architect, in the execution of which he has not in a great measure been compelled to abandon his original design, and adopt the suggestions (often incongruous) of his employers. Michael Angelo, in particular, was exposed to a like persecution, in his great work of St. Peter's, and alike had the harmony and beauty of his design impaired. After much cavilling the different objections were removed; Wren received an express order from the king to proceed according to his own plans; he was allowed to make what variations he pleased, and the whole was left to his own management. In thirty-five years from the commencement of the building, the highest and last stone was laid by Christopher, the son of the architect. Thus was this splendid edifice, admitted to be the second for grandeur in Europe, completed in thirty-five years by one architect, under one bishop of London, costing only 736,000*l.*, which was raised by a small impost on coals brought to London; whilst St. Peter's, the work of twelve architects, took one hundred and forty-five years to build, during the pontificate of nineteen popes.

One of the principal objections to the edifice is, that Wren chose two orders instead of one and an attic story, as in St. Peter's. That he intended to have adopted the single order (going from the top to the bottom) appears from what we have before stated. But whilst Bramante, for the erection of St. Peter's, had the quarries of Tivoli at his command, which yielded blocks of nine feet in diameter, amply sufficient for his columns, Wren had only the quarries of Portland, and from them he could not reckon on blocks greater than four feet in diameter, nor were even these readily procured; on which account, and that he might keep the just proportions of his cornice, (which Bramante, by the failure of the stone, had been compelled to diminish,) he finally determined on the use of two orders.

The dome of the Pantheon is no higher within than its diameter; the dome of St. Peter's is two diameters; and this appears too high, the other too low: Wren took a mean proportion, which shows its concave every way, and is lighted by the windows of the upper order, which permit the light to strike down through the great colonnade that encircles the dome without, and serves at the same time for the abutment of the dome itself, which is of two bricks thick, every five feet high having a course of bricks eighteen inches long bonding through the whole thickness. In consequence of the prejudice in favour of steeples, and that no disappointment might arise of the new church falling short of the old one, Wren, to give a greater height than the cupola would gracefully admit of, felt compelled to raise another structure over the first cupola. For this purpose he constructed a cone of brick, so as to support the vast stone lantern which surmounts it. This cone was covered with an oak roof, and this again with lead, in the same manner as the other parts of the church. Between this outside covering and the brick cone there are stairs to ascend to the lantern, lighted




1. Great Pyramid.
2. Spire of Mechlin.
3. St. Peter's.
4. St. Paul's.
5. Strasburgh Cathedral.
6. Hôtel de Ville, Brussels.
7. Salisbury Spire.
8. Notre Dame, Paris.
9. Pagoda by Sir W. Chambers.
10. Wellington's Testimonial.
11. Monument, London.
12. Trajan's Column.
13. Nelson's Column.
14. Obelisk, front of St. Peter's.
15. Cleopatra's Needle.
16. Leaning Tower at Pisa.
17. Temple of the Giants, Agrigentum.
18. Parthenon.

from the lantern above, which did away with the necessity of making the small ugly windows in the dome, as at St. Peter's. The inside of the whole cupola is painted by Sir James Thornhill, in eight compartments. In the crown of the vault, as in the Pantheon, there is a circular opening, by which not only the lantern transmits light, but the inside ornaments of the painted and gilded cone display a new and agreeable scene. Instead, however, of painting the dome, Wren had proposed it should, like that of St. Peter's, be enriched with the more durable and appropriate ornament of Mosaic, and had procured artists from Italy for its execution; but the ignorance and the prejudice of the persons employed as commissioners, in this, as in other cases, thwarted his views. The ornaments at the East end he designed should only be temporary, till the materials for the completion of a magnificent altar which he had planned could be procured.

In scale* and beauty of internal ornament, as well as material, situation, and climate, the work of Wren cannot come in competition with its great rival; but in architectural excellence it has fair claims to be placed on an equality; surpassing it in some things, if in others it falls short. The portico in front of St. Peter's, both for its beauty of proportion and vast size, is admitted to be a feature of high excellence and without any match in St. Paul's; yet the whole flat front of St. Peter's, terminating in a straight line at the top, cannot be said to afford such a pleasing variety as is bestowed by the elevation of the pediment in the middle, and the beautiful campanile towers at each end of the front of St. Paul's. One of the happiest parts of the invention is in the intersection of the three vistos of the nave, the aisles, and the cross and transept, attained by the octangular arrangement of the piers, which is as beautiful as it is novel, giving four additional views to the usual arrangement, and with an effect remarkable for its boldness and lightness. Figures 4 and 5, exhibit the ground plans of the two buildings drawn on

*Fig.* 4.

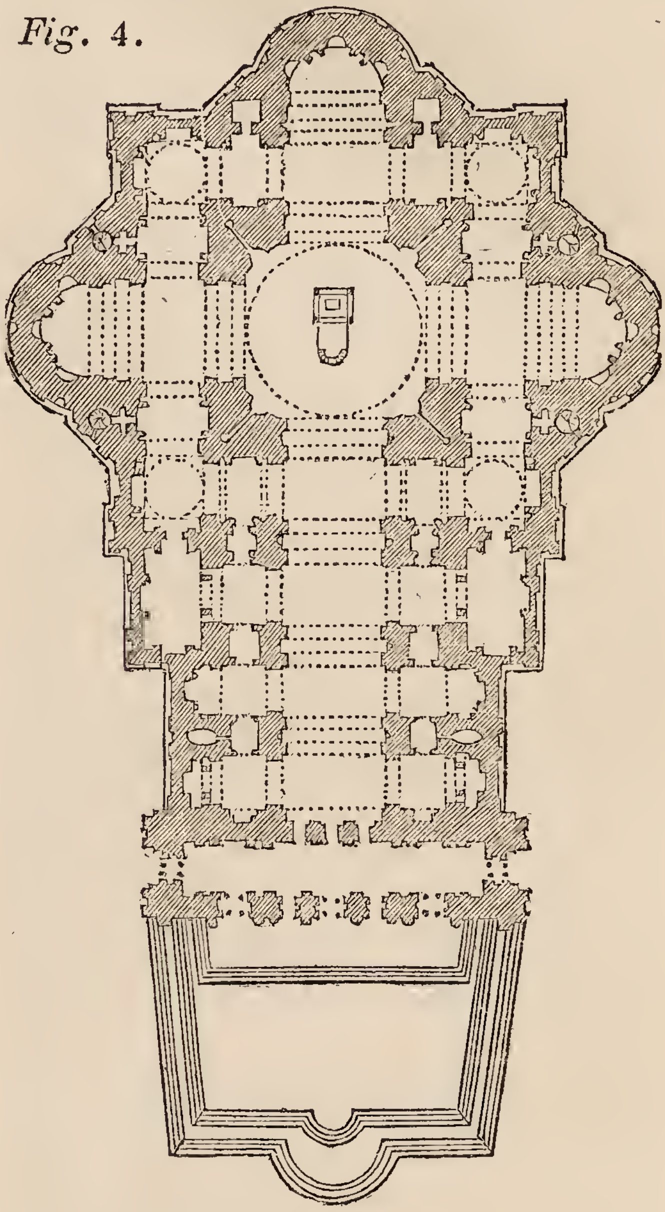
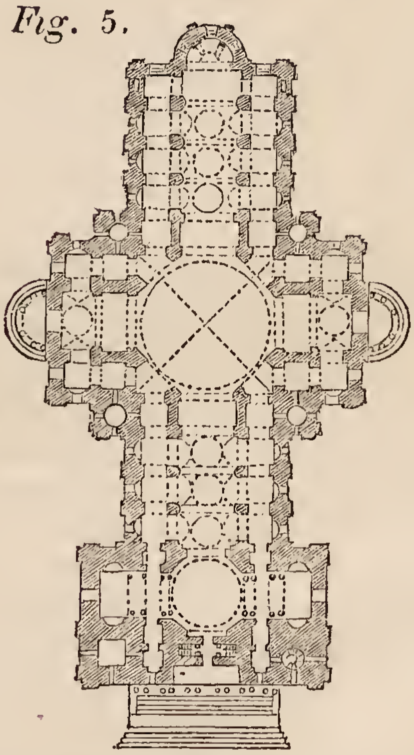


*Fig.* 5.



the same scale; the peculiarity noticed in the ground plan of St. Paul's is pointed out by the dotted lines. In St. Peter's the whole building is surrounded by a repetition of vast pilasters. In St. Paul's, however, take the building in any point of view, it

* *Relative Sizes.*

| | St. Peter's. | St. Paul's. |
|---|---|---|
| Long within | 669 | 500 |
| Broad at the entrance | 226 | 100 |
| Front, without | 395 | 180 |
| Broad at the cross | 442 | 223 |
| Cupola, diameter | 139 | 108 |
| Cupola and lantern, high | 432 | 330 |
| Church, high | 146 | 110 |
| Height of pillars in front | 91 | 40 |

is highly picturesque, the different returns and façades affording endless variety of views; no patching, no incongruous additions disfigure the unity of the composition, which, as a whole, for harmony of design and justness of proportion, has certainly never been surpassed.

With respect to the charge of plagiarism from the work of Michael Angelo, the two buildings are sufficiently different utterly to rebut this. The Romans adapted to their purposes the beauties of the architecture of Greece, combining them so as to suit their intentions; and Palladio, abandoning the barbarous taste of the middle ages, adapted the great remains both of Greek and Roman antiquity to the genius of the times, but did not repeat or copy them. Michael Angelo availed himself of the Pantheon in his cupola, and Wren, again, availed himself of the knowledge of M. Angelo; but there is nothing like servile copying, or unmeaning adaptation, in any one part of his work. To form a just idea of the relative sizes of the two buildings, we have added an outline, showing the comparative size of St. Peter's and St. Paul's, and the vacant spaces have been filled up with the outlines of some of the most remarkable buildings now existing, all on the same base and all drawn on the same scale, but unfortunately, owing to an error, the height of St. Paul's in the figure is a little less than it should have been. The buildings have principally been taken from the work of Mons. Durand, *The Parallel of Architecture*, by far the most important production of the kind which has yet been published, and affording great facility for the consideration of the general principles of architecture. It consists of ninety large folio plates, containing elevations and plans of the principal ancient and modern buildings and monuments, all drawn on the same scale. It is a matter of regret, that it is defective, inasmuch as, (either from jealousy or ignorance,) among the ninety plates, neither Westminster Abbey, York Cathedral, Greenwich and Chelsea Hospitals, our bridges, nor even our docks, (the largest in the world,) are inserted; and amongst the plans of English theatres, the only one given is that in the Haymarket.

In addition to the total want of the rich ornaments and the costly materials which adorn the interior of the church of St. Peter, it also far surpasses the building of Wren in the nature of the materials with which it is constructed. It has been a matter of regret that the quality of the stone used in the public buildings of this country has been hitherto but little attended to. Many of the public edifices of London, Edinburgh, Bath, and Oxford, furnish melancholy instances of the want of judgment in this choice of materials. It is obvious that the stone which is most porous, will, when exposed to the weather, be least durable: water lodges in its pores and penetrates the crevices, and by the mere change of temperature does mischief; but during frost the expansion is so great, that in a single winter the sharp parts often entirely crumble away. The fitness of the different species of sandstone for the purpose of building, may in a great measure be judged of by immersing the specimens in water, each being previously weighed, and all of one size; the excellence of the stone will be inversely to the quantity of water absorbed. The magnesian limestone, so abundant in England, is considered the best adapted for architectural purposes; it is far preferable to that termed the Oolite of Somersetshire and the Isle of Portland, of which the most important buildings have hitherto been constructed. Rain water always contains carbonic acid, which acts chemically on limestone, but less on those kinds which are fine grained and magnesian, than those which are coarse and free from magnesia; and although this often produces an external hardening, as in the Bath stone, it is only the forerunner of a more quick peeling off and destruction. It is obvious, that for durability, the granites, sienites, whinstones, and porphyries, are most to be preferred. The Strand Bridge is a magnificent example of the use of granite; the exterior being entirely constructed of two sorts, the coarse-grained granite of Devon and Cornwall, and the fine-grained and harder sort from Aberdeen, used for the balustrades, and stronger than that from Cornwall, as 22 to 14. The only means of proving the respective durability of them is from the effect of time; and the Cornish granite evidently appears to have suffered more decay than the harder stone of the North. Granite, however, independently of the great increase of expense incurred in the working it, is unfitted for all the finer parts of ornamental work;

in that case it would be well to adopt the marble or dolomite of Scotland, or the magnesian limestones, so much to be preferred to the perishable sand and lime stones of the west of England.* But the subject has not yet received its due share of attention from those whose pursuits and knowledge best enable them to form an accurate judgment upon it.

Although Wren's new employments occupied much of his time, his zeal for the advancement of science never forsook him; but, as he employed himself in the practical parts of building, his communications to the Royal Society became more technical, and applied principally to his own art. A very interesting letter to Lord Brounker, the first president of the Royal Society, is given by Mr. Elmes: it is in answer to a request to provide something for the suitable entertainment of his majesty, who had purposed visiting the Society. Upon this Wren observes, "The experiments for the establishment of natural philosophy are seldom pompous; it is upon billiard and tennis balls, upon the purling of sticks and tops, upon a vial of water, a wedge of glass, that the great Des Cartes has built the most refined and accurate theories that human wit ever reached to; and certainly nature, in the best of her works, is apparent enough in obvious things, were they but curiously observed; and the key that opens treasures is often plain and rusty, but unless it be gilt, the key alone will make no show at court." It does not appear how the philosophers succeeded in entertaining their royal guest. Wren in 1673 resigned the Savillian professorship, which he had held so long with credit. He was twice in Parliament, though it does not appear that he took any active part in the debates. In 1680 he was elected President of the Royal Society, and before that period he had been knighted by Charles II.

The delight one can well conceive a person of Wren's genius to have enjoyed, in the contemplation of the rise of the vast edifice which his creative genius had called into existence, was not undisturbed or unalloyed. Many improper persons were joined with him in the commission; and they, having private interests to serve, and selfish feelings to indulge, were thwarted by the inflexibility of Wren, who exposed at once their meanness and their ignorance. This, it may be supposed, was neither forgotten nor forgiven; and they joined in a cabal, persecuting him with every species of bitter malevolence. It will scarcely be supposed that one of Wren's genius and talent, of his gentle bearing towards all, his high patriotic feeling, at once the judge and the patron of every thing that was useful either in the arts or sciences, should have been subjected to the petty cavilling of a few interested persons without greatly retarding the progress of the building. But this was not all; the party having procured a clause to be inserted in an act of parliament, suspending a moiety of his pittance (200*l.* a year) till the building was finished, Wren was kept out of his money long after it was due, under the pretence that the building was not complete, whereas the cavillers themselves, by their impediments, alone hindered its completion. He was in consequence obliged to petition Queen Anne; and in his memorial he states, that the arbitrary proceedings of some of the commissioners had alone obstructed his measures for the completion of the work. This was handed over to the commissioners themselves for their answer, who replied by mean and paltry excuses. Wren, however, was not to be borne down by a low cabal: he next addressed the Archbishop of Canterbury and the Bishop of London, and the document itself affords ample testimony of the treatment he had received.

"The design of the parliament (he states) in granting the coal duty for the said cathedral, being to have the building completed with all possible speed, they did, to encourage and oblige the surveyor's diligence in carrying on the work, suspend half his allowance till all should be done. Whereby, I humbly conceive, it may justly from thence be implied, that they thought the building, and every thing belonging to it, was wholly under my management and direction, and that it was in my power to hasten or protract it. How far it has been so your lordships know; as also how far I have been limited and restrained. However, it has pleased God so to bless my sincere endeavours, as that I have brought the building to a conclusion, so far as is in my power; and I think nothing can be said now to remain imperfected, but the iron fence

* Brande's Journal, vol. iii. 381.

round the church, and painting the cupola, the directing of which is taken out of my hands, and therefore I hope that I am neither answerable for them, nor that the said suspending clause can, or ought to, affect me any further on that account. As for painting the cupola, your lordships know it has been long under consideration; that I have no power left me concerning it; and that it is not resolved in what manner to do it, or whether at all. And as for the iron fence, it is so remarkable and fresh in memory by whose influence and importunity it was wrested from me, and the doing it carried in a way that I may venture to say will ever be condemned. I have just this to observe further, that your lordships had no hand in it; and consequently ought not to share in the blame that may attend it.

"This, then, being the case, and nothing left that I think can keep the same clause of suspension any longer in force against me,

"I most humbly pray your lordships to grant your warrant for paying me what is due to me on that article, which was 1,300*l*. last Michaelmas. And if for the future my advice and assistance be required in any thing about the said cathedral, I will be ready to give the same, and to leave the consideration of it to your lordships."

This representation not succeeding, he applied at once to parliament, who rendered him that tardy justice, the long denial of which reflects so much disgrace on those who opposed his just claims.

"Whereupon that honourable and august assembly," says Sir Christopher,* "so considered his case, and were so well satisfied with the justice and the reasonableness of it, as to declare the church to be finished so far as was required to be done and performed by him as surveyor-general. And it was accordingly enacted, that the suspended salary should be paid him on or before December the 25th, 1711, which he has the truest sense of, and has not, he hopes, been wanting in all due acknowledgments and returns for it. Neither is it possible that he, or his posterity should ever forget so signal and distinguishing a favour, while he can remember the unjust and vile treatment he had from some in the late commission for St. Paul's; which was such as gave him reason enough to think that they intended him none of the suspended salary, if it had been left in their power to defeat him of it."

By the death of Anne, Wren lost the last of his royal patrons; in the new reign, the king's partiality for his German subjects and their connections deprived him of the sunshine of royal favour. His talents, his uprightness, and his fame were all forgotten: the corruption of that period in the disposal of patronage is well known. At last, after a severe struggle in the 86th year of his age and the 49th of his office as surveyor-general, he was deprived of his patent in favour of one Benson, his German influence prevailing over one who would not condescend to truckle even to a court, and whose life, as Walpole observes, having enriched the reign of several princes, disgraced the last of them. The intrigue which deprived him of his office is noticed in the memoirs of John Ker of Kersland; who states that, "so great was the influence of Benson, (a favourite of the Germans,) that Sir C. Wren, the famous architect who contrived the stately edifice of St. Paul's church, was turned out of his employment to make way for this favourite of foreigners." Pope also in a note to the *Dunciad* says, "In favour of this man, the famous Sir C. Wren, who had been architect to the crown for above fifty years, who built most of the churches in London, laid the first stone of St. Paul's, and lived to finish it, was displaced from his employment at the age of 90 years."

It may, indeed, be observed, that Wren's son was at this time member for Windsor, and probably some opposition to the wishes of the court might have had an influence on the father's fall. Benson himself, however, was soon disgraced and removed on the discovery of his ignorance and incapacity, and marked for public prosecution for his dishonesty; but the same influence, which had caused his original elevation, at once stopped the prosecution and loaded him with disgraceful rewards out of the public purse,* in the shape

* In a pamphlet which he published stating his case, and for the purpose of answering an attack made on him in a pamphlet entitled "Fraudulent Abuses at St. Paul's."

* Benson and Wren each had his due notice in the *Dunciad*.

Benson, sole judge of architecture, sit,
And namby pamby be preferred to wit;
While Wren with sorrow to the grave descends
Gay dies unpension'd with a hundred friends.

of reversionary grants and crown leases.

The following curious paper of Wren's is given by Mr. Elmes: it is in answer to the commissioners, who insisted on a balustrade to St. Paul's, none having been originally designed; and it is one of the long series of attacks which were made on him by his enemies.

"I have considered the resolution of the honourable the commissioners for adorning St. Paul's Cathedral, dated October 15, 1717, and brought to me on the 21st, importing that a balustrade of stone be set up on the top of the church, unless Sir Christopher Wren, in writing under his hand, set forth, that it is contrary to the principles of architecture, and give his opinion in a fortnight's time; and if he doth not, then the resolution of a balustrade is to be proceeded with.

"In observation of this resolution, I take leave, first, to declare I never designed a balustrade. Persons of little skill in architecture did expect, I believe, to see something they had been used to in Gothic structures; and *ladies think nothing well without an edging.* I should gladly have complied with the vulgar taste, but I suspended for reasons following:

"A balustrade is supposed a sort of plinth over the upper colonnade, which may be divided into balusters over open parts or voids, but kept solid over solid parts, such as pilasters; for a continued range of balusters cannot be proposed to stand alone against high winds: they would be liable to be lopped down in a row, if there were not solid parts at due distances intermixed, which solid parts are in the form of pedestals, and may be in length as long as the frieze below where pilasters are double, as in our case; for double pilasters may have one united pedestal, as they have one entablature and one frieze extended over both. But, now, in the inward angles, where the pilasters cannot be doubled, as before they were, the two voids or more open parts would be in the angle with one small pilaster between them, and create a very disagreeable mixture. I am further to observe, that there is already over the entablature a proper plinth, which regularly terminates the building; and as no provision was originally made in my plan for a balustrade, the setting up one in such a confused manner over the plinth must apparently break into the harmony of the whole machine, and, in this particular case, be contrary to the principles of architecture.

"The like objections as to some other ornaments, suppose of vases, for they will be double upon the solids; but in the inward angles there will be scarce room for one, though each of them be about two feet nine inches at bottom, and nine feet high: yet these will appear contemptible below, and bigger we cannot make them unless we fall into the crime of false bearing, which artisans of the lowest rank will have sense enough to condemn.

"My opinion, therefore, is to have statues erected on the four pediments only, which will be a most proper, noble, and sufficient ornament to the whole fabric, and was never omitted in the best ancient Greek and Roman architecture; the principles of which, throughout all my schemes of this colossal structure, I have religiously endeavoured to follow; and if I glory, it is in the singular mercy of God, who has enabled me to begin and finish my great work so conformable to the ancient model.

"The pedestals for the statues I have already laid in the building, which now stand naked for want of their acroteria.

"CHRISTOPHER WREN."

These details respecting the erection of a building which (if we except St. Peter's) is unrivalled in the world, will not, it is hoped, appear either trifling or tedious, but give an additional interest to the contemplation of that splendid monument of Wren's genius.

The character and fate of Michael Angelo and Wren were in many respects akin: remarkable alike for the universality of genius, each the builder of the greatest work of architecture of his time, each untainted by any vice, and regardless of private interests, (for Michael Angelo received no remuneration on account of St. Peter's,) they were both persecuted by the envious, and each had his works altered by the ignorant. Michael Angelo's severe honesty, in compelling those who received pay to give their labour in return, conjured up a whole host of enemies; and sickened with these obstacles he sought to free himself by the resignation of his charge. "I entreat your eminence," he writes to Cardinal Carpi, "to liberate me from this vexatious employment, which, by the command of the popes, I undertook seventeen years ago, during which pe-

riod I have given manifest proofs of my zeal in the prosecution of the work. I again earnestly entreat I may resign, which would be conferring on me the greatest favour."

Amongst the many willing to do justice to the merit and the modesty of Wren, when labouring under the persecution of court intrigue, was Sir Richard Steel, who, in his *Tatler*, No. 52, under the character of Nestor of Athens, observes that "his art and skill were soon disregarded for want of that manner with which men of the world support and assert the merits of their own performances; this bashful quality still put a damp on his great knowledge, which has as fatal an effect upon men's reputation as poverty, for it is said, (Ecclesiasticus, ch. ix. v. 15,) *The poor man by his wisdom delivered the city, yet no man remembered the same poor man.* So here we find *the modest man built the city, and the modest man's skill was unknown;* but surely posterity are obliged to allow him that praise after his death which he so industriously declined while he was living."

## Chapter V.

### *To the End of his Life.*

Wren quitted the field without a struggle; he retired in peace from the world to his home at Hampton Court, without being affected by any of that bitterness or those angry feelings which the ingratitude and injustice of a court so often engender in minds of less noble stamp, saying, *Nunc me jubet fortuna expeditius philosophari.* Cheerful in his solitude, and as well pleased to die in the shade as in the light—his son observes of him in the *Parentalia*, "that the vigour of his mind continued with a vivacity rarely found in persons of his age, till within a short period of his death, and not till then could he quit the great aim of his whole life to be (to use his own words) a benefactor to mankind; his great humanity appearing to the last in benevolence and complacency, free from all moroseness in behaviour or aspect; he was happily endued with such an evenness of temper, steady tranquillity, and Christian fortitude, that no injurious incidents or inquietudes of human life could ever ruffle or discompose."

The five remaining years of his life were passed in complete repose. Returning occasionally to superintend the repairs of Westminster Abbey, his only remaining public employment, he divided his time between the study of the Scriptures, which were at once his guide and his delight, and in the revision of his philosophical works, more particularly those upon the Longitude, and his tracts on Mathematics and Astronomy. Time, which had enfeebled his limbs, left his faculties unclouded till nearly the end of his existence. His chief delight to the very close of life was, that of being carried once a year to see his great work; "the beginning and completion of which," observes Walpole, "was an event which one cannot wonder left such an impression of content on the mind of the good old man, that it seemed to recall a memory almost deadened to every other use."

Wren's dissolution was as placid as the tenour of his existence had been. On the 25th of February, 1723, his servant conceiving he slept longer after his dinner than usual, entered his room, and found him dead in his chair.—He, to whom in his latter days all distinction had been denied, received, as frequently happens, the tardy honour of a splendid funeral; his remains were deposited in the crypt under the southernmost window of the choir of the Cathedral which he had raised; a plain black slab alone covers the coffin, but no monument beyond the Pile itself attests his goodness or his greatness. On the western jamb of the window of the crypt, is a tablet with this inscription:

Subtus conditur<br>
Huius ecclesiæ et urbis conditor<br>
Ch. Wren,<br>
Qui vixit annos ultra nonaginta<br>
Non sibi sed bono publico.<br>
Lector, si monumentum quæris<br>
Circumspice.*

Robert Milne, one of his successors in the care of the cathedral, caused this inscription to be placed in gilt letters in a tablet in front of the skreen of the organ: and it is a reproach to the nation and to the age, that no other monument has ever been erected. Indeed, until Mr. Elmes's volume, (with the exception of the *Parentalia,*)† no biographical notice

* "Beneath is laid the builder of this church and city, Christopher Wren, who lived above ninety years, not for himself but for the public good. Reader, if thou seekest for his monument, look around."

† *Parentalia, or Memoirs of the Family of the Wrens*, folio, London, 1750. This work was commenced by the son of Sir C. Wren, and was not completed till thirty years after his death, when it was published by his grandson, Stephen Wren. The work itself is of little interest; most of the facts it records have been adopted by Mr. Elmes, in his *Life of Wren*, 4to., 1823, and from these two works the biographical part of the present treatise has been chiefly compiled.

of him had been published. We trust, however, that before long Mr. Cockerel, the present architect to St. Paul's, who has lately superintended its repairs with so much judgment, will carry into effect an intention he is known long to have entertained, of giving to the world a critical account of Wren's most important architectural works, accompanied by a selection from the large collection of drawings now in the library of All Souls' College. Till this shall be done, it can hardly be said that his professional merits can be duly appreciated. Mr. Cockerel's attainments and talents afford a pledge that the work will be all that either the architect or the amateur can require.

Wren was twice married; first to the daughter of Sir Thomas Coghill, by whom he had one son, Christopher. He afterwards married a daughter of William Lord Fitzwilliam, Baron of Lifford, in Ireland, by whom he had a son and a daughter. The family is not extinct: Mr. Elmes mentions two daughters, and the son of his grandson Stephen, and Christopher Wren, the son of their cousin, of Wroxhall-abbey, in Warwickshire, a seat of Sir C. Wren's, where his only son, Christopher, is buried.

In considering the life of Wren we are struck with the splendour of his abilities, the greatness of his pereseverance and labour, the scantiness of his remuneration, and the ingratitude and injustice which he experienced towards the close of his long and arduous course. When the prices paid in these days to artists are called to mind, what must be the surprise at learning that the whole salary paid to the architect of St Paul's was only 200*l.* a year. Wren afforded all his services in the building of Greenwich Hospital, without any salary or emolument, preferring in this, as in every other passage of his life, the public service to private advantage. And it will be observed, that his salary of 200*l.* a year was not paid for his mere designs and time; it included the whole expense of models and drawings of every part, the daily overseeing of the works, the framing of the estimates and contracts, and auditing the bills. Without making any invidious comparison, it cannot be denied, that of late there have been few such examples shown of disinterested services towards the public by artists employed in situations similar to his. The scantiness of his pay was more than once noticed by the writers of the time; and Sarah Duchess of Marlborough, in a letter* respecting the charges of one of the persons employed to superintend the completion of Blenheim, who had made a charge of 300*l.* a year for his services, beside a salary for his clerk, complains bitterly at being compelled to pay this, "when," she observes, "it is well known that Sir C. Wren was content to be dragged up in a basket three or four times a week to the top of St. Paul's, and at great hazard, for 200*l.* a year."—Her Grace was perhaps but little capable of drawing any nice distinction between the feelings of the hired surveyor of Blenheim, and those of our architect in the contemplation of the rising of the fabric which his vast genius was calling into existence: her notions led her to estimate the matter by the simple process of the rule of three direct; and on this principle she certainly had good reason to complain of her surveyor.

## Chapter VI.

### *His other Works.*

In addition to the great work of St. Paul's, Wren, who was appointed the architect for the rebuilding of the whole city, superintended the erection of all the churches, amounting to more than fifty; he was also the architect and contriver of Chelsea College, and the principal officer and comptroller of the works at Windsor. A considerable part of Greenwich Hospital was erected by him, and a splendid palace for a hunting seat of Charles II., now turned into a barrack, was commenced at Winchester. In addition to all these duties, a large proportion of his time was occupied, after the fire of London, in setting out and ascertaining the sites of the different houses destroyed—an employment little suited to his genius, and which involved him in endless altercation. His pay as the architect for rebuilding the churches in the city, was not more liberal than for St. Paul's, being no more than 100*l.* a year; the parish of St. Stephen, Walbrook, however, appears, on his completing that admirable church, to have voted a present to his lady of twenty guineas!

In a sketch intended merely for general readers, it is not necessary to enumerate in detail the different churches erected by him: those which

* In the possession of W. Tooke, Esq.

are most celebrated for the beauty and convenience of the interior, are St. Stephen's, Walbrook, St. Andrew's, Holborn, and St. James's Church in Piccadilly. St. Stephen's is, by many, considered as the most perfect specimen of Wren's genius; and it has not, perhaps, been surpassed by any modern edifice in elegance and unity of design. It is an oblong square of seventy-five by fifty-six feet; its peculiar beauty arises from the elegance of the vaulting, the form of the cupola, the disposition of the Corinthian columns, the lightness of the supporting arches, and the distribution of the light from above. A judicious and elegant writer on the *Public Buildings of London* observes, "that this building, so little known amongst us, is famous all over Europe, and is reputed the masterpiece of Wren. Perhaps Italy itself can produce no modern building that can vie with it in taste or proportion. There is not a beauty which the plan would admit of, that is not to be found here in its greatest perfection: and foreigners very justly call our taste in question for understanding its graces no better, and allowing it no higher degree of fame." Such is the reputation of this structure amongst foreigners, that an anecdote is told of an Italian architect who arrived in London and immediately returned after having visited St. Stephen's.

The church of St. James, in Piccadilly, is divided, in the interior, into a nave and two aisles; the principal merit is in the formation of the roof, which is described from information furnished by Mr. Cockerel, as singularly ingenious and economical; and its simplicity, strength, and beauty, are represented as a perfect study of construction and architectural economy. Sir Christopher Wren, who himself conceived this to be one of the best contrived of his churches, observes in a letter—

"Churches must be large: but still, in our reformed religion, it should seem vain to make a parish church larger than that all who are present can both *hear* and *see*. The Romanists, indeed, may build larger churches: it is enough if they hear the murmurs of the mass, and see the elevation of the host; but ours are to be fitted for auditories. I can hardly think it practicable to make a single room so capacious, with pews and galleries, as to hold above two thousand persons, and all to hear the service, and see the preacher. I endeavoured to effect this, in building the parish church of St. James, Westminster, which, I presume, is the most capacious with these qualifications that hath yet been built; and yet at a solemn time, when the church was much crowded, I could not discern from a gallery, that two thousand were present. In this church I mention, though very broad, and the nave arched up, yet as there are no walls of a second order, nor lanterns, nor buttresses, but the whole of the roof rests upon the pillars, as do also the galleries, I think it may be found beautiful and convenient, and, as such, the cheapest of any form I could invent."

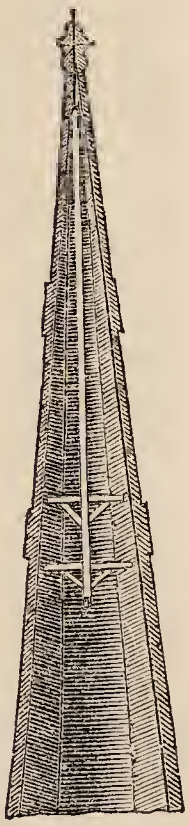
The interior of St. Andrew's, Holborn, after St. James's Church, affords one of the best specimens of arrangement; spacious, rich, and beautiful. It has a nave and two aisles divided into a basement and galleries: the length is a hundred and five feet, the breadth sixty-three, and the height forty-three.

No architect can come in competition with Wren in the construction of the steeple, which is considered a requisite in Christian churches, and in the composing of which it required his genius to combine the excellence of the Roman architecture, with the requisites of height and lightness, to which it had not before been adapted with any success. The spire of St. Dunstan's in the East is admitted to be unrivalled for elegance, and is one of the finest monuments of geometrical skill in existence. That of Bow Church is also among the most elegant of Wren's works; the bottom is a plain tower till it rises over the houses; above this is a beautiful temple, and over it stand flying buttresses supporting a lighter temple, surmounted by a spire. Nothing can afford fuller evidence of his power to combine and adapt the elegant features of the Roman architecture, so as to suit the genius of the work. Wren has not fallen into the common error in building spires, of making the spire straddle across a Greek pediment and crush it with the weight; thus, the spire of Bow Church is built separately, and rises from the ground at an angle of the church.

Another curious work of Wren was the pendulum stage in the upper part of the spire of the Chichester Cathedral, which he rebuilt, to counteract the south-westerly gales, which had forced it from its perpendicularity. (*Fig.* 6) A

sketch to illustrate this has been added from the work of Mr. Elmes. To the finial is fastened a strong metal ring, and to that is suspended a large piece of timber, 80 feet long, loaded with iron; at the bottom are two oak floors, the upper about two inches and a half, and the lower three inches less than the interior masonry of the spire. When the wind blows the spire out of the perpendicular, the pendulum floor touches the lee side of the spire, thus tending to restore the equilibrium of the masonry.

*Fig. 6.*



The Doric column at the foot of London Bridge, (Monument,) the largest single column in existence, except the Wellington testimonial, at Dublin, was also designed by Wren; its entire height is 202 feet, being 42 higher than Trajan's column; the pedestal is 40 feet high, 20 feet square; the diameter of the base is 15 feet, and there is a staircase in the shaft of 345 steps.

The works of Sir C. Wren do not appear to have been all uniformly successful. Hampton Court and Winchester Palace are far from being favourable specimens of the art. The studies made by him from the buildings of Louis the Fourteenth had too visible an effect on his own designs of palaces and private buildings; and "it may be considered fortunate," observes Horace Walpole, "that the French built only palaces and no churches, and therefore Saint Paul's escaped, but Hampton Court was sacrificed to the god of false taste." Wren's failure at Hampton Court may, in a great measure, be attributed to his having worked under the directions of William, whose favourite residence it was, and whose taste in architecture was far below his merit as a patriot king; indeed, when the arrangement of the low cloisters was criticized, the monarch, with his wonted honesty, took the whole blame on himself, acknowledging that they had been constructed by his own particular orders. Nor is it unreasonable to infer that in his other buildings, the defects arose in some degree from the taste of his employers, and that he was compelled by them to adopt the French fashions, which at that time retained the powerful influence in this country, which the profligate and frivolous court of Charles II. had bestowed upon them.

We have omitted to notice the College of Physicians,* built by Wren, which, in a particular department, was one of the most scientific of Wren's edifices. The exterior, indeed, was nowise to be admired; but in the interior, for the purposes of utility and convenience, it was considered perfect, as affording every facility both for seeing and hearing, in the display of anatomical operations and philosophical experiments. As a study of *acoustic* and *optical* architecture it was perhaps unrivalled, the peculiar character of the roof and form of the section being admirably adapted to the distribution of sound, and the form of the hall equally suited to the convenience of seeing.

In the construction of theatres and of churches, the propagation of sound is one of the most important points to be attended to. The doctrine of *acoustics* is little understood by builders in this country, and yet, however hidden to us the subject may be, it is certain the ancients understood its principles with great accuracy; whilst in modern times this important object of architecture has been almost wholly neglected. Vitruvius describes the effects of the science as well understood by the Greeks. The method of producing the effect of the increase of sound in their theatres was singular; and from the mention of it in Vitruvius, as being of frequent use both in these and in the Roman theatres, it is to be inferred that the effect sought was produced. The arrangement, as described, consisted in placing bronze vases or jars in small chambers or recesses having an opening in front in the *precinctio*, between the first and second row of seats. These jars were inverted, having one end partially raised: they were of different sizes, and are said to have been arranged according to some principle of harmony. It has been a matter of considerable surprise that, with the number of travellers who have been of late so actively exploring the antiquities of Greece and Italy, no remains of this contrivance have been discovered. Mr. Banks, however, it is said, discovered at Scythopolis the remains of these chambers situated in the precinctio,

* This building is now dismantled.

with doors at the back, apparently for the convenience of access to adjust the vases. This is an important subject of consideration in the construction of theatres, and more particularly in church architecture. In the present churches it not unfrequently happens that the architect ensures the congregation full opportunity of contemplating his edifice, by so building it that no articulate sound can reach half the persons present. There is another important point in the construction of churches, which has been hitherto mainly overlooked, namely, the advantage arising from what is termed *hypethral* light, or light from the roof. When this is adopted, the interior architecture has its own light and shade in the same way as the outside; and that solemn effect, so well adapted to sacred buildings, is attained by the appearance of seclusion and abstraction which the light coming from above instead of the sides is calculated to bestow.

Wren did not publish any works in his lifetime, except his contributions to the Royal Society, and his answer to the attacks made against him. In the *Parentalia*, a few fragments of essays are printed, some of which contain very judicious observations on the science of architecture. The limits of this sketch do not, however, permit any very long extracts; the following are, perhaps, the most interesting:

"Position is necessary for perfecting beauty. There are only two beautiful *positions* of *strait lines*, perpendicular and horizontal; this is from nature, and consequently necessity, no other than upright being firm. Oblique positions are discord to the eye, unless answered in pairs, as in the sides of an equicrural triangle; therefore *Gothic* buttresses are all ill-favoured and were avoided by the ancients, and no roofs, almost, but spheric raised to be visible, except in the front, where the lines answer in spheric in all positions the ribs answer. Cones and multangular prisms want neither beauty nor firmness, but are not ancient.

"Views contrary to beauty are deformity, or a defect of uniformity: and plainness, which is the excess of uniformity: variety makes the mean.

"Variety of uniformities makes complete beauty. Uniformities are best tempered, as rhymes in poetry, alternately, or sometimes with more variety, as in stanzas.

"In things to be seen at once much variety makes confusion, another vice of beauty. In things that are not seen at once, and have no respect one to another, great variety is commendable, provided this variety transgress not the rules of *optics* and *geometry*.

"An architect ought to be jealous of *novelties*, in which fancy blinds the judgment; and to think his judges as well those that are to live five centuries after him, as those of his own time. That which is commendable now for novelty, will not be a new invention to posterity, when his works are often imitated, and when it is unknown which was the original; but the glory of that which is good of itself, is eternal.

"The architect ought above all things to be well versed in *perspective*, for every thing that appears well in the orthography may not be good in the model, especially where are many angles and projections; and every thing that is good in model may not be so when built; because a model is seen from other stations and distances than the eye sees the building; but this will hold universally true, that whatsoever is good in perspective, and will hold so in all the principal views, whether direct or oblique, will be as good in great, if this only caution be observed, that regard be had to the distance of the eye in the principal stations.

"Things seen near at hand may have small and many members, be well furnished with ornaments, and may lie flatter; on the contrary, all this care is ridiculous at great distances; there bulky members and full projections casting quick shadows are commendable; small ornaments at too great distance serve only to confound the symmetry and to take away the lustre of the object, by darkening it with many little shadows.

"There are different reasons for objects, whose chief view is in *front*, and for those whose chief view is *sideways*.

"Fronts ought to be elevated in the *middle* not the *corners;* because the middle is the place of greatest dignity and first arrests the eye; and rather projecting forward in the middle than hollow. For these reasons pavilions at the corners are naught, because they make both faults, a hollow and depressed front. Where *hollows* and *solids* are mixed, the hollow is to be in the middle; for hollows are either niches, windows, or doors. The first require the middle to give the statue dignity; the second, that the view from within may be direct; the third, that the visto may be straight. The ancients elevated the middle with a tympan and statue, or a dome, The triumphant arches, which now seem flat, were elevated by the magnificent figure of the victor in his chariot with four horses abreast, and other statues accompanying it. No sort of pinnacle is worthy enough to appear in the air but statue. Pyramids are *Gothic;* pots are modern *French.* Chimnies ought to be hid if not well adorned. No roof can have dignity enough to appear above a cornice but the circular: in private buildings it is excusable. The ancients affected flatness. In buildings where the view is sideways, as in streets, it is absolutely required that the composition should be square; intercolumniations equal; projections not great; the cornices unbroken, and every thing strait, equal, and uniform. Breaks in the cornice, projectures of the upright members, variety, inequality in the parts, various heights of the roof, serve only to confound the perspective and make it deformed; while the breaches and projections are cast upon one another and obscure all symmetry. In this sort of building there seems no proportion of length to the height; for a portico the longer the more beautiful, in infinitum; on the contrary, fronts require a proportion of the breadth to the height; higher than three times the breadth is indecent, and as ill to be above three times as broad as high. From this rule I except obelisks, pyramids, columns, such as Trajan's, &c., which seem rather single things than compositions; I except also long porticoes, though seen direct, where the eye, wandering over the same members, infinitely repeated, and not easily finding the bounds, makes no comparison of them with the height."

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"Modern authors, who have treated of architecture, seem generally to have little more in view, but to set down the proportions of columns, architraves, and cornices, in the several orders as they are distinguished into Doric, Ionic, Corinthian, and Composite; and in these proportions, finding them in the ancient fabrics of the Greeks and Romans, (though more arbitrarily used than they care to acknowledge,) they have reduced them into rules, too strict and pedantic, and so as not to be transgressed without the crime of barbarity; though, in their own nature, they are but the *modes* and *fashions* of those ages wherein they were used; but because they were found in the great structures, (the ruins of which we now admire,) we think ourselves strictly obliged still to follow the fashion, though we can never attain to the grandeur of those *works.*"

## Chapter VII.

*The School of Wren.—His Successors.*

It may be proper to close this treatise with a few observations on the successors of Wren,—on the present taste for architecture,—and on the French school.

Hawkesmore, Vanbrugh, Gibbs, and others, of the same date, followed in his footsteps, proceeding upon the foundations laid by the revived or Palladian school. Hawkesmore was amongst the most successful pupils; he was so considered by his master, and he certainly surpassed his contemporary, Vanbrugh. It is observable, that after the age of Wren, something beyond the pitch of the art was attempted by his immediate successors, and amongst the foremost in this attempt was Hawkesmore. Something beyond the orders, something almost colossal appears to have been effected; but although there was a partial success, it seems as if something greater was intended than was, or indeed could be, attained. The works of Hawkesmore evince great beauties of conception, but mixed with so many caprices and so many defects, that he has perhaps never yet received his due share of credit.

The steeple, as applied to a building on the plan of a Grecian or Roman temple, is always absurd, and even Wren himself could not always rescue it from deserved and contemptuous criticism: but Hawkesmore appears to have been the only one who has ventured to place this steeple on one side of the building, as in St. George's, Bloomsbury; by this means avoiding at least the incongruity of making a steeple rise out of a temple. St. George's, Limehouse, and St. Mary's Wolnoth's, may be considered as the best specimen of his style; and the beautiful portico of St. Martin's in the Fields, now again about to see the light, is the masterpiece of Gibbs.

Amongst the succeeding class in the Palladian school, the most conspicuous were Ware, Sir William Chambers, and the Adams. Sir William Chambers's works are remarkable for their taste and elegance, and for a purer imitation of the antique of Italy. The Adams, with many defects chiefly from falling into the details of the Venetian school, produced works worthy of admiration, and were the first who investigated the Roman baths and the remains of the Roman villas, thus opening a new source of architectural combination, of which they often took great and judicious advantage. The Library at Luton is one of the most striking examples of this happy adaptation.

Without being entirely devoted to what is termed the Palladian school, or wishing to be supposed insensible to the beauty of the pure Grecian architecture, it must be admitted that the present taste for the pure Greek is carried too far. While we acknowledge the excellence of the great original, there is danger that some of the present professors may lose sight of the valuable additions which architecture has acquired from the labours of the Romans, and after them from the Revival school. These improvements are more adapted to utility than the Grecian architecture, which was besides deficient in some of the most important principles of magnificence, as for instance those obtained by the introduction of the arch, which opened a new field for grandeur, variety, and extent, and enabled the architect to cover a space beyond the power or combination of the Greeks to reach. It is almost impossible, by taking the very few existing examples of Grecian architecture (consisting only of sacred edifices) as models, to erect buildings calculated to serve the infinitely varied purposes of modern wants, without the risk of distortion and misapplication. The excellence of Greek architecture consisted in its principles of elegance and proportion, and what may be termed the detail, rather than its utility for the great purposes of construction. The shape of the Grecian temple admits of no change without the destruction of its beauty: add a side wing as a vestry, or let a tall spire shoot up above the low tympanum, and every principle of proportion and fitness is destroyed. Besides, the thing we produce has little resemblance to the original: the Grecian temple was designed to form a feature in the surrounding landscape, to be a vehicle for the exposition of sculpture, of the most exquisite and elaborate kind; it was radiant with gold, azure, and vermilion, laid on the pure marble; the delicate mouldings were to be seen under an unclouded sun, and to remain in a climate which conserved an unchanged appearance for ages. How different is the copy, cooped up in the smokes of a great city, composed of coarse materials, and without any aid of ornament, except a few mock stone vases or figures wretchedly executed!

The exclusive admiration of the Grecian architecture is becoming the cant of the day. It is impossible to agree with the dogmas of the professors in their exclusion of all the resources which the ingenuity of the moderns has furnished, and which the necessities of greater civilisation require: yet this different and less intolerant opinion may be entertained without any deficiency in admiration of the beautiful specimens of antiquity. This country is greatly indebted to the publications of Stuart and Revett, and of the Dillettanti Society, who first cultivated the true taste for Grecian antiquities, and laid accurate representations of them before the public. Stuart, whose original employment was that of painting fan mounts, but whose talents and industry enabled him to surmount all difficulties, conceived the happy idea of going to the original source of the beautiful in the arts; and from reading the Grecian history, figured to himself that there must remain at Athens a purer style than had been adopted either by the Romans or by the Revival school. He performed the journey on foot, with very slender resources, and joining company with Mr. Revett, produced the work which has redounded so much to the credit of himself and of his country. His project immediately excited the jealousy and with it the rivalry of the French, who despatched Le Roy in order to anticipate their labours, which he did by publishing his work at Paris long before the work of Stuart and Revett appeared. Le Roy however employed only twenty-one days in executing that which his rivals were engaged on for three years. The result might be easily foreseen. Le Roy's book soon sold for waste paper, and the *Athenian Antiquities* have since their publication in England been reprinted at Paris.

In mentioning the different great artists of the English school, we should do injustice in omitting the names of several distinguished amateur architects. Amongst the foremost of these stand Lord Pembroke, Lord Burlington, Lord Leicester, Dr. Aldriche, and Dr. Clarke, whose labours have tended so much to the advancement of the science, and whose works redound so much to their credit.

In comparing the French and English modern schools of architecture, Monsieur Le Grand, in his Essay, has very candidly admitted our superiority: "The English," he says, "adopted Palladio, whilst we have followed the orders of Vigniola; but with this difference;—they adopted the plans of Palladio entire, and accompanied by all their elegance and simplicity, whilst we have applied the orders of Vigniola to the most complex shapes in our buildings, and which we have overloaded with whimsical ornaments of the very worst taste; and the result of a comparison between the ancient architecture and ours is, that our own is complex, whilst that of the ancients was simple; theirs exhibits grand ideas in the most trifling edifices, whilst ours, in the execution of the greatest objects, are but a collection of small parts, and those united with difficulty, which is miscalled ingenuity."

The fact is, the French were ambitious of forming a new school: they were to invent new *orders* which were to be exclusively French; and their buildings in the age of Louis XIV. exhibit examples, in which all kinds of incongruous ornament are collected together without principle or meaning. To this succeeded what they conceived to be the pure Grecian taste; but as it was before the Grecian monuments had been studied or understood, this second manner was in truth very little more elegant or perfect than the former. They are scarcely ever successful in their attempts to adopt the styles of antiquity: although there is no nation so prone to affect a species of classical show, and none more ambitious of giving to the productions in art a classical air. This is observable particularly in their school of design, and in their drama; and yet it is impossible to contend that they have been successful. The difference of taste and manner between the French and the English, may, perhaps, be accounted for in some degree by their different modes of study. The French both in their studies and in their pursuits adopt more of the academic system than is followed in England; they work in bodies, and under the direction of the government, whilst our most laboured productions are the works of individuals, and consequently more likely to afford specimens of originality, if not of perfection. Without entirely denying the benefit of academies for the advancement of the arts, it is only from frequent experience of their failure through mismanagement, that the argument arises against increasing their number, or extending their influence.

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STEVENSON, W.

# LIFE OF WILLIAM CAXTON,

WITH

## AN ACCOUNT OF THE INVENTION OF PRINTING, AND OF THE MODES AND MATERIALS USED FOR TRANSMITTING KNOWLEDGE BEFORE THAT TOOK PLACE.

The ease, which we now find in providing, and dispersing, what number of copies of books we please, by the opportunity of the press, makes us apt to imagine, without considering the matter, that the publication of books was the same easy affair in all former times as in the present. But the case was quite different. For, when there were no books in the world, but what were written out by hand, with great labour and expense, the method of publishing them was necessarily very slow, and the price very dear; so that the rich only and curious would be disposed or able to purchase them; and to such also it was often difficult to procure them, or to know even where they were to be bought.—*Middleton's Free Enquiry*, p. 198.

### CHAPTER I.

*Introductory—Different kinds of Biography—Kind to which that of Caxton belongs—Principal object in selecting it—Nature and arrangement of the subjects necessary to be touched upon in order to attain that object.*

THE lives of some men supply scanty materials for private and personal biography; whereas the materials that connect them with the advancement of the human race in knowledge, civilization, and happiness, are, in no common degree, rich and interesting. Such is the case with the life of William Caxton. Very few of the events of his life are known; and it is highly probable that, if we had them in minute detail, they would have presented nothing very curious or very instructive,—nothing that would have justified us in selecting his life, on account either of the insight it afforded into the formation of the human mind and character, or of the impressive and practical lesson it taught, that, in moral conduct, as certainly as in the material world, like causes will always produce like effects. Such lives as give this insight, and teach by powerful and repeated examples this most important, but too often neglected truth, are certainly of the highest utility as well as interest: they give biography a just claim to be ranked above all other studies, in so far as it teaches, most emphatically, that close attention, and persevering and zealous industry, are absolutely necessary for the acquisition of knowledge; and that these qualities, united with probity, are equally necessary to our success in the world, and to our usefulness and respectability in society.

The biography of those men, however, whose lives have contributed to the improvement of the human race, even though they have displayed no superior talent, ought, by no means, to be neglected. Such lives must always command interest, and they may be so written as to convey useful information. On these accounts we have chosen the life of William Caxton. Through his zeal, industry, and perseverance, the art of printing was introduced into England, and firmly established here. It is a trite remark, that we know very little of the value, or even of the real nature of those advantages which have been familiar to us from our infancy, which we see all around us, the want of which never entered into our imagination, but of which, in times not very remote, our ancestors were utterly ignorant, and which are still unknown to the great majority of mankind.

At present, in our country, there could not, most probably, be found a single hovel in the most lonely and remote district, in which some books would not be found—not treasured as a great rarity and of high value, but, on the contrary, accessible to all. The art of printing has done this. Before it was found out, few books were to be seen except in monasteries, universities, and the libraries of those who were very fond of literature, or very rich. They were preserved by such as had them with the utmost care; guarded against loss equally with their most precious jewels; and never lent except with the utmost

precaution, and the best security for their return.

*Now*, when we wish to purchase a book, we go into a bookseller's shop, pay its price, and, without delay or formality, it is our own. *Then*, if the manuscript were rare and costly, the transfer by purchase was often conducted in a manner as circumspect, and guarded by as strict and legal evidence, as were necessary in the sale and purchase of an estate. *Now*, very little labour or time is requisite to ascertain where the scarcest books are to be procured. *Then*, as Dr. Middleton remarks, it was not only often difficult to procure them, but even to know where they were to be bought. *Now*, a small portion of the week's wages of a labouring man is sufficient to purchase books, which, while only existing in manuscript, could not be obtained except at the cost of a sum equal to his whole year's earnings: and for the manuscripts of many works, sums were *then* given equivalent (taking the value of money at those periods into the account) to the income of most persons in the middle ranks of life at present, and to what would now purchase a whole library suited to their station and adequate to their desires.

*Then*, not only did all books exist solely in manuscript, but, in many instances, there were few copies of those manuscripts; in some cases, perhaps not a dozen. Their destruction, therefore, at all times and under all circumstances, must have been no improbable event; and in those days of almost uninterrupted warfare and devastation, it very frequently occurred. Some were absolutely destroyed, no copies remained; others were mutilated and rendered imperfect, and their imperfections could not be removed. Others were lost by negligence, or too much care for their preservation during scenes of rapine and warfare, and in the midst of the plunder of ignorant and barbarian soldiers; and thus withdrawn, for ever, or for a long period, from the perusal and instruction of mankind. *Now*, since the invention of printing, the utter destruction, or the irreparable mutilation of a book, cannot scarcely occur, at least after it has once passed from the printing-office into the shops of the booksellers: if such an event could take place even then, the dispersion of an usual edition of seven hundred or one thousand copies among purchasers in every part of the kingdom, renders it perfectly secure from destruction or loss.

In the days of manuscript books, what expense and labour must have been submitted to, what a length of time must have elapsed, before an author could have conveyed his discoveries, or reasonings, or instructions, what would benefit or bless human life, to one thousandth part of the number of readers to whom the art of printing enables him to convey the fruits of his study or imagination with infinitely less expense and labour, and in an infinitely shorter space of time! What would our ancestors, who lived before printing was discovered, have said, had they, after having been present in the House of Commons till two or three o'clock in the morning, read at their breakfast table a detailed account of speeches, which had occupied nearly twelve hours in the delivery, and learnt that not one or two, but many thousand copies were, at that time, circulating?

Such is a very general representation of the state and means of literary communication before printing was discovered: whoever reflects on it will not be surprised that the progress of mankind, in every thing useful and valuable, was extremely slow and difficult. Individual and uncommunicated knowledge cannot purify itself from error; and, till printing was discovered, how much knowledge must necessarily have been individual and uncommunicated! The greater the number of minds that are brought to bear on any topic of research, experiment or thought, the sooner will its truth be ascertained and established. But when "there were no books in the world but what were written out by hand, with great labour and expense, the method of publishing them was necessarily very slow, and the price very dear, so that the rich only and curious would be disposed and able to purchase them." In these circumstances, error gained strength; important and valuable truths died at their very birth, or struggled useless and unproductive till the art of printing nourished them to maturity, and enabled them to strike their roots deeply and widely, and to produce their natural and genuine fruit of practical good to the human race.

But no general picture, however strongly and accurately it may be drawn, can speak so emphatically, either to the understanding or the imagination, as a picture, the outlines of which are filled up with strokes, minute but characteristic. No general contrast can exhibit a dif-

ference so clearly and powerfully as a contrast that enters into detail, and sets the individual circumstances directly in array against one another.

The facts already stated may enable and dispose our readers to prize, with some degree of justice, the advantages derived from the art of printing, and to form a vague and imperfect notion of what the state and amount of knowledge must have been, when all the books in the world were written out by hand. But we think we shall render these feelings and impressions much more vivid, distinct and permanent—we shall set the inestimable advantages derived from the art of printing in a clearer and more powerful light—we shall impress the contrast between our own means of improvement and those possessed by our ancestors, and even by the enlightened philosophers of Greece and Rome, in the very noon-tide of their intellectual vigour and glory, more deeply—if, before we give a sketch of the invention of printing, and of the life of Caxton, by whom the infant art was introduced into this country, and established here—we devote two chapters to a detail—first, of the modes and materials employed for the communication and transmission of knowledge among the Greeks and Romans, and during the dark and middle ages; and secondly, of the writing and copying of manuscripts—where it was executed, and by whom—their rarity and value—destruction—loss and recovery. We shall take care that the facts detailed in these chapters are well established—that they are curious and interesting, and, above all, that they bear directly and powerfully on the grand object we have in view,—to draw the deliberate attention and the well-grounded belief of our readers to this important truth, that the press has bestowed, is at present bestowing, and cannot cease to bestow, on mankind greater blessings than any other art has done or can do; since, without it, knowledge, and, consequently, all the benefits derived from knowledge, must have crept on with slow and feeble steps, whereas, with it, knowledge must proceed at a steady, onward pace, and with a vigour that will tread down or remove every obstacle.

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## Chapter II.

*A Description of the Modes and Materials for communicating and transmitting Knowledge before the Invention of Printing.*

The few and simple laws, necessary in the very earliest stages of society, seem, at first, among the Greeks, to have been set to music, and chanted or sung. Afterwards they were engraven on a hard and solid substance, as stone, metal or wood. According to some authors, the laws of Solon were engraved on tablets of wood, so constructed that they might be turned round in wooden cases. Some of his laws, however, were certainly engraven on stone. The laws of the Twelve Tables among the Romans were engraven on oaken planks, ivory tables, or brass; most probably on the last. In order to give the Athenians an opportunity of judging deliberately on a proposed law, it was engraven on a tablet, which was hung up for some days at the Statue of the Heroes, the most public and frequented place in the city of Athens. And that no man might plead ignorance of his duty, the laws, when passed, were engraven on the walls of the royal portico; and persons were appointed to transcribe such as were worn or defaced, and to enter the new ones. The Arundelian Marbles, preserved in the University of Oxford, sufficiently prove for what a variety of purposes inscriptions on stone were used among the ancients. Some of the inscriptions on them record treaties, others the victories or good qualities and deeds of distinguished persons, others miscellaneous events: most of them, however, are sepulchral. By far the most important and celebrated is the Parian Chronicle, which, when entire, contained a chronology of Greece, particularly of Athens, for a period of 1318 years, viz. from the reign of Cecrops, A. C. 1582, to the archonship of Diognetus, A. C. 264. The Romans engraved on brass, even so late as the reign of the Emperors, in general, their code (plebiscita), contracts, conventions, and public records. The landmarks of estates were engraven on the same metal. The Roman soldiers were allowed, in the field of battle, to write their wills on their bucklers or scabbards; and in many cabinets are preserved the discharges of soldiers, written on copper plates. Lead was employed as well as brass for preserving

treaties and laws. And Pausanias informs us that he had seen, in the Temple of the Muses, the Works and Days of Hesiod, inscribed on leaden tables. In the year 1699 Montfauçon purchased, at Rome, a book of eight leaden leaves, (including two which formed the cover,) four inches long and three inches wide. Leaden rings were fastened on the back, through which a small leaden rod ran, to keep the leaves together.

Wood, however, was most generally used, both for public and private purposes, in various forms and modes. The inscription of laws on it has been already mentioned. Even in the 4th century the laws of the Emperors were published on wooden tables, painted with white lead; and formerly the Swedes inscribed or engraved their laws on wood: hence their term Balkar (laws), from *balkan*, a balk or beam. Wooden boards, either plain or covered with wax, were used long before the age of Homer: the former were called Schedæ, whence our word *schedule*. At first, the bare wood was engraven with an iron style: the overlaying them with wax was a subsequent invention. The styles used in both cases were of metal, ivory, or bone; one end pointed, the other smooth, for the purpose of erasing: hence our word *style*, used metaphorically, to signify the choice and arrangement of words employed by an author to express his thoughts. These tablets, or thin slices of wood, when fastened together, formed a book, *Codex*, so called from its resemblance to the trunk of a tree cut into planks. Hence our word *code*. When the Romans wrote letters on their tablets, they fastened them together with thread, and put a seal upon the knot. Table-books continued in use so late as the fourteenth century, and even later, as Chaucer evidently describes one in the Sumpner's Tale*. They were then formed into a book by means of parchment bands glued to the backs of the leaves. The Roman boys used them at school; and in the middle ages, young men learning the sciences had table-books, and psalms for meditation were written on them. The expenses of Philip le Bel, written on tables of wax, may be seen in the library of St. Victor, at Paris; and in the archives of the town-hall of Hanover, are twelve wooden boards, covered with wax, on which are inscribed the names of the owners of houses in that city. There is reason to believe that this enumeration was made at the beginning of the fifteenth century. The ancients generally used box and citron wood; in the middle ages beech was principally employed. The rich Romans used thin pieces of ivory, instead of wooden tablets. The edicts of the senate, the proceedings of the Roman magistrates, the principal transactions of the emperors, and the affairs of the princes, were recorded on ivory leaves or tablets. These were deposited in the magnificent library founded by Trajan at Rome.

The employment of leaves for the transmission of ideas is of great antiquity; and it is still common in different parts of the east. Hence the word *folio*, (from the Latin folium, a leaf,) and the meaning of *leaf*, when applied to a book. This mode of writing on leaves seems to have been superseded by the use of the bark—a material employed in every age and quarter of the globe. The outer bark was seldom used, being too coarse and rough. The inner bark was preferred, especially that of the lime tree. This bark the Romans called *liber*—hence *Liber*, the Latin name for a book. In order that these bark books might be conveniently carried they were rolled up; and in this form called *volumen;* this name was afterwards applied to rolls of paper and parchment—hence the origin of the word *volume*, applied to modern books, though of a different shape. Ancient manuscripts in bark are very scarce; but the use of bark for books still prevails in the east, especially among the Birmans. The custom of making books from bark prevailed among our Scandinavian and Saxon ancestors: the bark of the beech tree was most commonly used. The primitive meaning of the Anglo-Saxon word *boc* is the beech tree; its secondary meaning, a book—and hence our word, *book*. There are still extant some letters, and even love-letters, written by the ancient Scandinavians on pieces of bark. A very curious library of the kind was discovered some time ago among the Calmucs: the books were very long and narrow; their leaves of thick bark, varnished over; the writing white on a black ground.

Linen cloth, on which letters were drawn or painted with pencils, was employed by the Egyptians when, it is supposed, they wished to transmit such things as they designed to last very long.

* His felaw had a staf tipped with horn,
A pair of tables, all of ivory,
And a pointel (style) ypolished fetisly (neatly),
And wrote always the names, as he stood,
Of all folk that yave hem any good. (v. 33-37.)

In the British Museum there is a piece of writing of this nature, taken out of a mummy. The Romans likewise employed linen (*libri lintei*) not merely for what related to private subjects and persons, but also to enter the names of magistrates, treaties, and other public documents.

The employment of the skins of animals, rudely prepared, is stated by Herodotus to have originated with the Ionians, as a substitute for the papyrus, when it could not be procured without much difficulty and expense: those of sheep, goats, and asses were preferred. Several of these books are in the Vatican, the Royal Library of Paris, and some other libraries. The poems of Homer were written on the intestines of a serpent in letters of gold: this roll was first deposited in the library of Ptolemy Philadelphus, and afterwards taken to the great library of Constantinople, where it was destroyed by fire in the sixth century: it was 120 feet long.

Leather, or skins prepared in the present manner, seems to have been often used by the Jews, on which to write the Law, Pentateuch, and other parts of their Sacred Scriptures. Dr. Buchanan informs us, that in the coffer of the synagogue of the Black Jews, in Malayala, there is an ancient copy of the Law, written on a roll of leather; it is about fifteen feet long; the skins are sewed together. A copy of the Pentateuch, written beautifully in Hebrew characters, (without vowel points,) large, and of a square form, belonged formerly to M. Santander. It occupied fifty-seven skins, which were fastened together with the same material.

The Egyptian papyrus was applied to the purpose of writing upon before the preparation of parchment and its application to the same use were known. But in order to notice in connexion all the subjects employed by the ancients, which have been entirely superseded (except in very few instances) by the use of paper, we shall postpone our account of the papyrus, till we have stated a few particulars regarding the ancient use of parchment.

The common opinion, derived from the authority of Varro and Pliny, that the preparation of parchment from skins owes its origin to a dispute between Eumenes, King of Pergamus, and one of the Ptolemies, concerning their respective libraries, in consequence of which the Egyptian king prohibited the exportation of papyrus, and Eumenes invented parchment, is certainly unfounded. Its manufacture and use are mentioned by Josephus, Diodorus Siculus, and other authors, as having been known long before the age of the Ptolemies: the name given to it by the ancients, however, Charta Pergamena, (paper of Pergamus,) renders it highly probable that its mode of preparation was improved, or its manufacture and use more general there, than in other places. Most of the ancient manuscripts now extant are written on parchment. From their appearance, the parchment has evidently been polished: according to ancient authors, by the pumice stone. They used three kinds—that of the natural colour; the yellow, bicolor membrana of Persius, which seems to have been so called because one side of the leaf was white, the other yellow; and the purple; the parchment being tinged with that colour, when silver or golden letters were to be used. It sometimes happened that parchment of the very finest kind was extremely scarce: about the year 1120, "one Martin Hugh, being appointed by the convent of St. Edmundbury to write and illuminate a grand copy of the Bible, for their library, could procure no parchment for this purpose in England."

Vellum, a finer kind of parchment, made from the skins of very young calves, was also prepared and used by the ancients, and in the dark and middle ages, for writing upon. There is one manuscript of vellum, of a violet colour, all the letters of which are of silver, except the initials, which are of gold,—which we particularly notice, for two reasons: first, it is the only specimen extant of the parent tongue, from which our own language, and the languages of Sweden, Denmark, Iceland, Norway, the Netherlands, and Germany, are derived; and, secondly, it was long supposed by many to exhibit a very near approach to printing, nearly 1000 years before the art was invented—we allude to the Gothic translation of the Gospels, by Ulphilas, in the fourth century. An imperfect copy of it is preserved in the library of Upsal. It is called the 'Codex Argenteus,' or silver book. The letters appear, and were generally judged, to have been stamped or imprinted, singly, on the vellum, with hot metal types, in the same manner as book-binders at present letter the backs of books. We are not aware that this opinion was called in question, till Mr. Coxe minutely and closely examined the MS., when

he convinced himself that each letter was painted, or drawn in the same manner as the initial letters in several of the finest missals. He seems also doubtful, whether to call the leaves vellum, parchment or papyrus.

We come now to paper. The most ancient kind was made from the *papyrus*, whence the word *paper* is derived. This is a species of rush, which the ancients procured exclusively on the banks of the Nile. The particular species, till lately, was not known; but it is now ascertained to be the cyperus papyrus of Linnæus, growing on the banks of different rivers in the east, and likewise, we believe, in Trinidad. The term *biblos*, originally applied by the Greeks to the inner bark of trees, and equivalent to the liber of the Romans, was afterwards more usually applied to the papyrus. Thence the term was transferred to books in general; and now it is confined by us to the scripture, as *the* book.

It is not known when the papyrus was first manufactured into paper; but there were certainly at a very early period, at least three hundred years before Alexander, manufactories of it at Memphis. Afterwards, and at the time of the conquest of Egypt, by the Romans, it was made chiefly at Alexandria. Till this conquest, however, the paper was of inferior quality. The Roman artists paid great attention to its improvement, and at length made it of considerable thickness, perfectly white and smooth. Even in this state, however, it was so friable and weak, that, when great durability was requisite, leaves of parchment were intermixed with those of papyrus. "Thus the firmness of the one substance defended the brittleness of the other, and great numbers of books, so constituted, have resisted the accidents and decays of twelve centuries."

The papyrus was highly useful to the ancient Egyptians, on many accounts, besides that of supplying them with paper: from the pith they extracted a sweet and nutritive juice; from the harder and lower parts they formed cups, &c.; staves, and ribs of boats, from the upper and more flexible part; and the fibrous part was manufactured into cloth, sails, ropes, strings, shoes, wicks for lamps, and paper. Pliny gives a full description of the manner in which it was made by the ancients; and Bruce, who succeeded in making it, both in Abyssinia and Egypt, has offered several very curious observations on the natural history of the papyrus, in the seventh vol. of his Travels, 8vo. edition, page 117, &c. In one point he differs from the account given by Pliny, of the mode of manufacturing paper from it. According to the latter, one layer of the fibrous coats of the plant was laid across another layer, on a table; they were then connected together by the muddy water of the Nile. Mr. Bruce affirms, that the water of the Nile is in no degree glutinous, and that the strips of papyrus adhere together solely by means of the saccharine matter, with which the juice of the plant is abundantly impregnated. He adds, that the Nile water must have been used simply to dissolve this saccharine matter, perfectly and equally. The cemented fibres were pressed, dried, beat with a mallet, and polished with a tooth, shell, or other smooth and solid substance. The Roman artists, in Alexandria, paid great attention to the operations of washing, beating, glueing, sizing, and polishing. It was sized in the same manner as paper from rags is at present. After the first sizing, it was beat with a hammer; sized the second time, pressed, and then polished. It was then cut into various sizes,—never more, however, according to Pliny, than thirteen inches wide. The same author mentions a great variety of kinds, to each of which a specific name was given.

For at least three hundred years before Christ, this article was exported in large quantities from Egypt. Of the extent and value of the manufactures, in Alexandria, and of the wealth derived from them, we may form some idea from an anecdote of Firmus. This person, the friend and ally of Zenobia, queen of Palmyra, a wealthy merchant, or rather manufacturer of paper and glue, in Alexandria, broke into that city in the middle of the third century, at the head of a furious multitude, "assumed the imperial purple, coined money, published edicts, and raised an army, which he boasted he could maintain from the sole profits of his manufactures." The time when the manufacture of this paper was lost, or superseded, is not known. The possession of Egypt by the Saracens certainly interrupted and diminished its manufacture and export; and it is generally supposed that few, if any, manuscripts on papyrus are of a later date than the eighth or ninth century. About this period, cotton paper was first made:

according to some, in Bucharia; according to others, it had been known long before in China and Persia. There is no doubt, however, that the Arabs, having gained a knowledge of the process, established a manufactory at Ceuta, and afterwards in Spain; and thus introduced it into Europe, about the twelfth century. In the next century this paper was in common use in the eastern empire, and in Sicily. At first it was made of raw cotton; then of old worn-out cotton cloth. While the paper manufactories of Spain were possessed by the Arabians, this article was of a very coarse and inferior quality, in consequence of their employing only mortars, and hand or horse-mills, to reduce the wool or cloth to a pulp; but as soon as their Christian labourers got possession of the paper mills of Toledo and Valencia, they worked them to more advantage, by the use of water-mills, an improved method of grinding and stamping, and by the invention or adoption of moulds. The use of cotton paper became general only in the thirteenth century; and about the middle of the fourteenth, it was almost entirely superseded by paper from linen rags, such as is at present made and used in Europe, and wherever Europeans have settled or colonised. There is much uncertainty respecting the exact time when linen paper was invented, and in what country. It is probable that at first a mixture of cotton and linen rags was employed, especially in those countries, where flax was much and easily cultivated, and where cotton was an article of import, and consequently scarce and dear. Montfauçon, who, on these subjects, is great authority on account of the diligence and extent of his researches, could find no books, either in France or Italy, made of linen paper, before the year 1270. A specimen a little earlier, however, in 1239, has been discovered by De Vaines. In the fourteenth century, the use of this kind of paper became general. Italy seems to have had paper manufactures, for exportation, at this time. In 1380, part of the cargo of a ship, from Genoa to Sluys, in Flanders, which was driven ashore on the coast of England, consisted of twenty-two bales of writing paper. The oldest German paper-mill was erected at Nuremberg, in 1390. There are English manuscripts, on linen paper, so early as 1340 and 1342; but the manufacture was not introduced, according to the general opinion, into this country, till the year 1588. At that time a German, named Spielman, jeweller to Queen Elizabeth, erected a paper-mill at Dartford, in Kent. This opinion, however, has been controverted on good grounds; as the paper used by Wynkyn de Worde (who may justly be considered as Caxton's real successor) for Bartholomeus, *de proprietatibus rerum*—described by Mr. Dibdin, "as one of the most splendid typographical productions of the early British press," was made at Hertford by John Tate, junior, who may therefore be deemed the earliest paper-maker in England.* Our principal supply of fine paper, for printing and writing, was from the Continent—(Holland and France chiefly)—till about one hundred years since. At this period two-thirds of the paper used was home made; at present, besides manufacturing sufficient for our own use, we export it to a considerable amount.

The instruments employed to write with, by the ancients, and in the dark and middle ages, of course varied according to the nature of the materials on which they wrote. They may be divided into two kinds: those which acted immediately, and those which acted by the assistance of fluids; of the first kind were the wedge and chisel, for inscriptions on stone, wood, and metal; and the style, for wax tablets. The last has been already mentioned and described; the others need no description. As the style was too sharp for writing on parchment and Egyptian paper, and moreover, was not adapted for holding or conveying a fluid, a species of reed was employed. The Egyptian reeds were preferred, but many others were also used. They were cut in the form of our modern pens, and split in the points; when they became blunt, they were sharpened either with a knife, or on a rough stone. Persons of rank and fortune often wrote with a calamus of silver—something probably like our silver pens. However carefully made or mended, the strokes made by the reed-pens were in general coarse and uneven. Both the styles and the reeds were carefully kept in cases. From ancient authors, as well as from the figures in manuscripts, we learn that they used a sponge to cleanse the reed, and to rub out such letters as were writ-

* John Tate, the younger—
Which late hath in England do make this paper thynne,
That now in our English, this boke is printed inne.
*Proemium to Bartholomeus*, about 1491.

ten by mistake; a knife for mending the reed; pumice, for a similar purpose, or to smooth the parchment; compasses for measuring the distances of the lines; scissars, for cutting the paper; a puncher, to point out the beginning and end of each line; a rule, to draw lines, and divide the sheets into columns; a glass, containing sand, and another glass filled with water, probably to mix with the ink.

Neither the particular species of calamus, used as pens by the ancients, nor the manner in which they prepared them for this purpose, is known. This is remarkable, since all the places, where these reeds grow wild, have been ascertained, and explored by botanists: with so little success, however, that after a variety of learned as well as scientific conjectures, the calamus of the ancients has not yet found a place in the botanical system of Linneus.

This is yet more remarkable, as reeds are still employed by many eastern nations to write with. Ranwolf, who travelled in the sixteenth century, informs us that canes for pens were sold in the shops of Turkey, small, hollow within, smooth without, and of a brownish colour. Tavernier, Chardin, Tournefort, and other travellers, give a similar account, adding, that the reeds are about the size of large swan quills, and are cut and split in the same manner that we do quills, except that their nib is much larger. The best grow near the Persian Gulph. It is highly probable, that, of whatever species these are, they are of the same as those employed by the ancients; and that the mode of preparing them, still practised in the east, was followed by the ancients. They are put for some months in a dunghill; this gives them a dark yellow colour, a fine polish, and the requisite hardness.

Reeds continued to be used even so late as the eighth century, though there can be no doubt that quill pens were known in the middle of the seventh. The earliest author who uses the word *penna* for a writing pen, is Isidorus, who lived in that century; and towards the latter end of the same century, a Latin sonnet to a pen was written by an Anglo-Saxon author. There is, indeed, in the Medicean Library, a MS. of Virgil, written in the beginning of the 5th century, evidently, from the gradual and regular fineness of the hair strokes, by some instrument as elastic as a quill; but there is no proof that it was really written with a quill. Considering that pens from quills were certainly known in the seventh century, they must have come into general use very slowly; for in 1433, a present of a bundle of quills was sent from Venice by a monk, with a letter, in which he says, "Shew the bundle to Brother Nicholas, *that he may choose a quill.*"

The composition and the colours of the ink used by the ancients were various. Lamp-black, or the black taken from burnt ivory, and soot from furnaces and baths, according to Pliny and other writers, formed the basis of it: the black liquor of the cuttle fish is also said to have been used as ink, principally on the authority of a metaphorical expression of the poet Persius. But of whatever ingredients it was made, it is certain, from chemical analysis, from the solidity and blackness in the most ancient manuscripts, and from an inkstand found at Herculaneum, in which the ink appears like a thick oil, that the ink then made was much more opaque as well as encaustic than that used at present. Inks, red, purple and blue, and also silver and gold inks, were much employed by the ancients; the red was made from vermilion, cinnabar, and carmine; the purple from the *murex*; one kind of this coloured ink, called the sacred encauster, was set apart for the sole use of the emperors. The subscription at the end of most Greek manuscripts, containing the name of the copyist, and the year, month, day, and sometimes hour, when he finished his labour, were generally written, in the period of the Lower Empire, in purple ink. Golden ink was used by the Greeks much more than by the Romans. The manufacture both of it and silver ink was a distinct and extensive, as well as a lucrative business in the middle ages; and another distinct business was that of inscribing the titles, capitals or emphatic words, in coloured and gold or silver inks.

## Chapter III.

*Manuscript Books—where written and copied, and by whom—Causes of their Destruction or Loss—their Rarity and high price—Libraries—Schools.*

The foregoing chapter proves very strongly and clearly the obstacles and impediments in the way of the communication and transmission of knowledge

among the ancients, and in the dark and middle ages, in so far as the nature of the materials employed for those purposes is concerned. Masses of stone or marble, metal, or blocks or planks of wood, were too heavy and cumbrous to circulate: in order to learn what the inscriptions on them related to, it was necessary that they should be consulted on the spot. Even after better materials were used, such as tablets, parchment, and the papyrus paper, the difficulties and disadvantages were great. Wax tablets might answer for notes, letters, or very short treaties, but scarcely for writings of any great length. Besides it appears that they were chiefly intended and applied for private use, and never circulated. Parchment never could have been abundant and cheap; and being, at least during the Greek and Roman period, manufactured exclusively or principally, in one place, other parts of the world must have been dependant for their supply upon it. Papyrus paper was cheaper, and in much greater abundance; but for a supply of it, the world was indebted to Egypt alone; and we have seen how this supply was cut off or much diminished when the Saracens obtained possession of that country.

The invention of paper from linen rags succeeded. Dr. Robertson remarks that "it preceded the first dawning of letters and improvement in knowledge towards the close of the eleventh century, and that by means of it, not only the number of manuscripts increased, but the study of the sciences was wonderfully facilitated." So far, indeed, as respects *material*, after this period, the European world was nearly as well off for the means of circulating and transmitting knowledge, as we of the present day are. But we must never lose sight of this fact, that all books were manuscript, written by the hand. How this was accomplished, by whom, and where, form part of the inquiries answered in the present chapter.

If we look at the voluminous works of some of the ancient Fathers or schoolmen, we must be struck with astonishment, when we reflect that copies of them were made by the pen alone, and that their circulation, which seems to have been extensive, could not proceed unless the pen supplied copies. From this single fact, we shall be prepared to expect that the copyists of books must, at all times before the invention of printing, have been very numerous; following a regular business, that afforded full employment, and required experience and skill, as well as legible and expeditious writing.

This was indeed the case in Greece, Rome, Alexandria, and other places before the Christian era; and after its establishment, in the monasteries, universities, and many other places. At Athens copyists by profession were numerous, and gained a steady and considerable livelihood, as, notwithstanding their number and labours, books were seldom very common. The booksellers of Athens employed them principally to copy books of amusement, most of which were exported to the adjoining countries on the shores of the Mediterranean, and sometimes even to the Greek colonies on the Euxine. In many of these places the business of copying was carried on, and libraries formed. Individuals also employed themselves, occasionally, in copying; and there are instances recorded of some forming their own libraries by copying every book they wished to put into them. Not long after the death of Alexander, the love of science and literature passed from Athens and Greece generally, to Alexandria, where, patronised by the Ptolemies, they flourished vigorously, and for a considerable period seemed to have concentred themselves. Under the same roof with the celebrated library there, (which is said to have contained at one time 700,000 volumes,) were extensive offices, regularly and completely fitted up for the business of transcribing books: and it was the practice of foreign princes, who wished for copies of books, to maintain copyists in this city. Some of the libraries of Rome, having been destroyed by fire, the Emperor Domitian sent copyists to Alexandria, that he might be able to replace them. This practice continued for some centuries after Domitian, probably till the conquest of Egypt by the Saracens in the middle of the seventh century. The supposed invention of parchment by a king of Pergamus has already been mentioned. This is doubtful; but it is certain that there were extensive manufactories of that article there, almost entirely for the use of the copyists, who were attached to the royal library; this is said to have contained 200,000 books.

We are ignorant of the class of people in ancient Greece, by whom the business of copying was chiefly followed, and of the education they received. But

we know, that, in Rome, the copyists were usually slaves who had received a liberal education. Sometimes they were freedmen, especially those employed by private individuals. The Romans, of rank and consequence, seldom wrote their works, speeches, or even letters themselves;—it was customary for them to dictate to such of their slaves or freedmen, as had been liberally educated, who wrote the MS. in a kind of short hand, or rather in contractions and signs which stood for words and syllables. If the work was intended for publication, it was sent to the booksellers who employed people to copy it fairly in the ordinary characters. This kind of short hand is said to have been invented by Xenophon: it was certainly much extended and improved by the Romans. Tyro, Cicero's freedman, in copying the speeches of Cato, first regulated the method of taking down public harangues—hence their *notæ* took his name, *Notæ Tyronianæ;* they were in use in the tenth and eleventh centuries. Many of the speeches of Cicero and other distinguished statesmen and orators, in the senate or at the forum, were taken down by short-hand writers stationed there. Extreme rapidity of writing was absolutely necessary: this led them to contract words more and more, and to multiply the number of the contractions. In many cases, either for the sake of greater expedition, or of secrecy, "signs or marks which could be currently made with one dash or scratch of the *style*, and without lifting or turning it, came to be employed, instead of those letters which were themselves abbreviations of words. This mode of dictation, and of rapid and abbreviated writing, continued to be practised, at least as late as the fourth century."

This, itself, must have occasioned many errors; but the chief source of errors in the MSS. of the ancients arose from the transcribers employed by the booksellers; these were often ignorant and careless; and complaints on that score are made against them, at a very early period, by Lucilius, in one of his satires, and afterwards by Cicero, Strabo, Martial, and other authors. Strabo informs us that in his time the copyists were so careless that they neglected to compare what they wrote with the exemplar: this, he adds, has been the case in many works copied for sale, at Rome and Alexandria. Individuals seldom copied books for their own use at Rome. Plutarch, indeed, mentions, that Cato the Censor, out of his great anxiety for the education of his son, wrote out, for his use, with his own hand, in large letters, such historical works as he wished him to read; but this is evidently noticed as an extraordinary and unusual action. When a person, from the absence of his scribe or other cause, wrote his letters himself, the extreme rapidity to which he had been accustomed while dictating, unavoidably produced rapid and illegible writing. Cicero, in reply to the complaint of his brother Quintus, that he could not read his letters, tells him that when he wrote himself, he wrote with whatever pen he took up, whether good or bad *.

When the seat of the Roman empire was transferred to Constantinople, that city, for upwards of one thousand years, became the chief seat of literature, and source of books. The liberality and munificence of the emperors in purchasing books, and having them copied, are repeatedly noticed, especially by the Byzantine historians. The manuscripts executed in that city are, in general, beautifully written, and sometimes most splendidly decorated. Though the number of books, and the demand for them in ancient times, were, comparatively, extremely limited, yet, in consequence of the frequent destruction of manuscripts, by common accidents and casualties, the business of copyists must have been very extensive. When the Roman empire began to decline, their destruction was extended and increased in the midst of the turbulence and rapine of the civil contests for the imperial throne. Christianity, properly understood, and exercising its due influence on the understanding and character, must be a warm friend of knowledge and literature: but the spurious Christianity, believed and acted upon in the dark ages, was hostile to some of the noblest productions of the human mind. The temples of the Heathens, with the public libraries they contained, were the objects of vengeance and destruction. The classics were represented as sinful books. In addition to these causes, the capture of Rome in the fifth century,—the devastations committed by Alaric, Genseric, and Attila—and the plunder of Milan, which,

* Quintilian informs us that wax tablets were preferred to paper, when it was necessary or desirable to write with rapidity, as the pen required to be frequently raised from the paper, to be dipped in the ink—an intermission and delay not required when writing with the style on tablets.

next to Rome, was the principal repository for books in Italy—greatly reduced the number of manuscripts, or contributed to their mutilation.

Soon after monachism was regularly formed in the sixth century, the monks, especially those under the rules of St. Benedict, which did not prohibit the reading of the classics, turned their attention to procuring and copying manuscripts. Most of these indeed were worthless; but truth obliges us to add, that many of the abbots, and even monks, employed themselves in procuring or copying the choicest works of Greece and Rome*. Cassiodorus, to use the words of Gibbon, "after passing thirty years in the honours of the world, was blessed with an equal term of repose in the devout and studious solitude of Squillace." To this place, the monastery of Monte Cassino, in Calabria, he carried his own extensive library, which he greatly enlarged by manuscripts bought at a considerable expense in various parts of Italy. His fondness for literature spread among the monks; he encouraged them to copy manuscripts; and even wrote a treatise giving minute directions for copying with correctness and facility. What he did there seems to have been imitated in the other monasteries of that part of Italy; for fifty religious houses there are mentioned, which afterwards principally supplied the libraries of Rome, Venice, Florence, and Milan, with manuscripts. The north of Italy had also similar establishments in monasteries for copying. The monastery of Benedictines at Bobbio, according to Tiraboschi, was celebrated for its cultivation of literature. The same author fixes the systematic commencement of the copying of the classics in the sixth century. The monasteries of the Morea, and of the islands of Eubea and Crete, but more especially the numerous religious houses which covered the heights and sides of Mount Athos, had always some of their inhabitants employed in the transcription of books.

It was a fixed rule in religious houses that all their inmates should devote a portion of the day to labour. Such as were unable to work at employments requiring toil and strength, or particular skill, discharged their duty by copying manuscripts; and as it was another rule, that every vacancy should be filled up, as soon as ever it took place, there was always a considerable number of copyists. In every great abbey, an apartment, called the *scriptorium*, was expressly fitted up, as a writing-room. That of St. Alban's abbey was built about 1080, by a Norman, who ordered many volumes to be written there; the exemplars were furnished by Archbishop Lanfranc. Estates and legacies were often bequeathed for the support of the scriptorium, and tithes appropriated for the express purpose of copying books. The transcription of the service books for the choir was intrusted to boys and novices; but the missals and Bibles were ordered to be written by monks of mature age and discretion. Persons qualified by experience and superior learning were appointed to revise every manuscript that came from the scriptorium. The copying of books was executed in other places besides monasteries; sometimes by individuals, from their attachment to literature; but generally by persons who made it their professed employment. Richard of Bury, bishop of Durham, in the thirteenth century, is highly celebrated for his love and encouragement of literature. Besides his libraries, which were numerous in all his palaces, and the books which covered the floor of his common apartments, so that it was no easy matter to approach him, he had a great number of copyists, illuminators, and binders, in his pay. While Chancellor and Treasurer of England, he preferred receiving the usual perquisites of his office in books, instead of the usual new year's gifts and presents. Copyists were found in all the great towns; but were most numerous in such as had universities. It is said that more than six thousand persons at Paris subsisted by copying and illuminating manuscripts, at the time when printing was introduced into that city: they held their privilege under the University. We know little certain of the rate at which copyists were paid; one fact, however, mentioned by Stow, in his 'Survey of London,' may be given: In 1433, 66*l*. 13*s*. 4*d*. was paid for transcribing a copy of the works of Nicholas de Lyra, in two volumes, to be chained in the library of the Grey Friars. The usual price of wheat at this time was 5*s*. 4*d*.

* Some of the early fathers employed much of their time in dictating their works. Eusebius gives a curious picture of Origen's mode of composition: he had seven *notarii*, or short-hand writers, who succeeded each other, as they became weary with writing: he had also a regular establishment of men and young women, who wrote beautifully, to copy his works.

the quarter. The wages of a ploughman were one penny a day; of a sawyer, four-pence; and of a stone-cutter, the same*.

The Jews practised the business of copying, and greatly excelled in fine and regular writing. But they confined their labours chiefly to the Old Testament, and their own religious books. In some of the Hebrew manuscripts, executed by them, the letters are so equal, that they seem to have been printed. Even at present, as Mr. Butler remarks, "those who have not seen the rolls used in the synagogues, can have no conception of the exquisite beauty, correctness, and equality, of the writing."

The ancients most commonly wrote only on one side of the parchment or paper, joining the sheets together till their work was entirely written†. The manuscript was then rolled on a cylinder, and called volumen. More than one book was seldom included in a volume. Thus the fifteen books of Ovid's Metamorphoses, were in fifteen volumes. The volume being formed, a ball of wood, bone, ivory, &c., was fastened to it on the outside, for ornament and security. This was the most ancient mode of binding books, if so it may be called; and it was followed long after the time of Augustus. The square form, it is said, was first given to books by one of the kings of Pergamus; and it is certain that Julius Cæsar introduced the custom of dividing his letters to the senate, and folding them like our books. Previously to his time, when the consuls wrote to the senate, their letters were rolled up in a *volume*.

* It must be noticed, however, that the illuminations, as well as the ornaments, are probably included in the sum; if not the materials used, at least the workmanship. The works of Nicholas de Lyra seem to have been in high repute, and much honoured. John Whethamstede, abbot of St. Alban's, highly celebrated for his studious employment and love of literature, began, during his abbacy, a grand transcript of the Postilla of De Lyra; the ornaments and hand-writing were most splendid. The monk, who mentions it, and who lived after him, when it was still unfinished, exclaims, "God grant that this work may receive, in our days, a happy consummation."

† Pasting the leaves together was a distinct and regular business, carried on by persons called glutinatores. In parchment there appear to have been ruled lines to direct the writing; whereas, when writing on paper, which in general was very fine, and almost transparent, a leaf of ruled paper was put beneath. The double paper, mentioned by Pliny, on both sides of which the ancients wrote, was made by pasting two leaves together, in such a manner that the grain of the paper was crossed. The blank side of manuscripts, written on single paper, was sometimes used for rough drafts, or given to children for copy-books—hence the Latin term, *adversaria*,—a note-book, loose papers.

When books were exposed to sale, they were covered with skins, which were rendered smooth by pumice-stone. There was one particular street in Rome, or rather a part of one street, in which the booksellers chiefly lived. In the middle ages books were usually bound by monks. There were also trading binders, called ligatores, and persons whose sole business it was to sell covers. White sheep-skin, pasted on a wooden board, sometimes overlapping the leaves, and fastened with a metal cross, was the most common kind of binding. It was deemed the duty of the sacrists in particular to bind and clasp the books. There is a curious charter of Charlemagne's, in 790, to the abbots and monks of Sithin, by which he grants them an unlimited right of hunting, on condition that the skins of the deer they killed should be used in making them gloves and girdles, and *covers for their books*.

We know little about booksellers in the early part of the dark ages; it is probable, indeed, that for many centuries there was no mode of procuring a copy of a book but by borrowing it, and employing a copyist, to transcribe it. Books, however, as well as other articles, were occasionally sold in the porches of the churches—a place where law meetings were held, and money paid, in order that its payment might be attested, if necessary, by some of the persons there assembled. We may suppose that, for the same reason, books were sold there. This custom seems to have been adopted from a similar one which prevailed in the porticoes of the Greek and Roman temples; for in them goods were sold, and business transacted. We may also trace to the schools which were established there, for children even of the highest rank,—the custom mentioned by Shakspeare, of parish schools being held in the porch, or in a room above the church.

Mr. Hallam says booksellers appear in the latter part of the twelfth century; and quotes Peter of Blois, who mentions a law book which he had bought from a public seller of books. The Jews of Spain about this period were much devoted to literature: Leo Africanus alludes to one Jewish philosopher of Cordova, who, having fallen in love, turned poet: his verses, he adds, were publicly sold in a street in that city, which he calls the Booksellers'-Street; this was about the year 1220. The Greek and Roman

authors adopted rather a singular custom, either to make their works sell after they were actually published, or, more probably, to create a disposition to purchase them when they should come into the hands of the booksellers. We learn from Theophrastus, Juvenal, Pliny, and Tacitus, (particularly from the last,) that a person who wished to bring his writings into notice, hired or borrowed a house, fitted up a room in it, hired forms, and circulated prospectuses, and read his productions before an audience, there and thus collected. Giraldus Cambrensis did the same in the middle ages, in order to make his works known.

Having thus given an account of the manner in which manuscripts were copied and increased in monasteries, &c. we shall now state the causes of their destruction and loss. Till the establishment of Monachism, Christianity, or rather its blind and bigoted professors, were hostile to the classics; —the monasteries in a great degree made up for this by the care they took and the copies they made of them. But one of the causes of their destruction arose, even in the monasteries. The high price of parchment at all times, and its firm and tough texture, tempted and enabled the ancients to erase what had been written on it, (especially, we may suppose, when the contents were of little moment,) in order to use it again for writing upon. A manuscript of this kind was called a Palimpsest. Cicero's self-love took the alarm when his friend Tribatius wrote a letter to him on such parchment. After praising him for his parsimony, he expresses his wonder what he had erased to write such a letter, except it were his law notes; "for I cannot think that you would efface my letter to substitute your own." This practice, in the dark and middle ages, became so prevalent, and was productive of such serious consequences, the most important documents often being destroyed to make way for trash, that the emperors of Germany, in their patents of nobility, with power to create imperial notaries, inserted a clause to the following effect: "On condition that they should not make use of old or erased parchment, but that it should be quite new." The parchment was generally erased: but the monks had also a practice of taking out the writing by a chemical process; and sometimes they peeled off the surface of the parchment. They had recourse to these destructive practices, not only when they wished to add to their stock of religious works, but also when they wanted to raise a sum of money. In this case, they erased the old writing—paying little regard to its value or rarity—wrote a legend or a psalter, and sold it to the common people. Though it had been long known that the writings of classical authors lay concealed and nearly obliterated beneath the literary rubbish of the monks—and this in numerous cases—for Montfauçon affirms that the greater part of the MSS. he had examined were of this description; yet no steps were taken to recover the original and more valuable writings, till Angelo Mai undertook the task: he has succeeded in recovering several works, the most important of which is a considerable portion of Cicero de Republica that had been erased, and replaced by St. Augustine's Commentary on the Psalms.

The conquest of Egypt by the Saracens, which rendered it almost impracticable to procure papyrus paper, and the consequent high price of parchment, and temptation to erasure, were injurious to literature, not only in this respect, but by the alarm it gave to Europe. This event, their subsequent conquest of Spain, the Norman invasion of France, and the wars by which various parts of Europe were so long and dreadfully afflicted, afforded opportunities and pretexts for plundering the convents and cities, and thus caused the destruction and loss of a great number of valuable manuscripts.

We have already alluded, generally, to the facility with which books can be procured now, and the extreme difficulty even of ascertaining where they were to be found before the invention of printing; when that was ascertained, of gaining access to them, or a loan of them; and the high price at which they were then sold. We shall now give several instances of the truth of this general statement, for, in no other manner, can we so clearly point out and prove the very great advantages that literature and science have derived from the art of printing. The materials employed formerly to write upon—the cumbersome or perishable nature of some—the dearness of others—the length of time necessarily taken up, in writing books with the hand—the few places in which they were accumulated—the difficulty of access to them—their liability to destruction,

—and the practice of the monks' erasing the writing,—have prepared our readers to anticipate their great rarity and value. We must premise, however, that though the facts we shall state will sufficiently prove the high price of manuscript books, yet we cannot gain a precise notion of the subject, because, in many cases, that arose in a great measure from the splendour of their illuminations, and cost of outward workmanship—and, setting aside this consideration, because it is not possible to ascertain exactly the comparative value of money in those ages, and in the present times. Where we have dates, we shall add the price of wheat, and the wages of labour—perhaps the best criteria for ascertaining the purchasing power of money. We shall begin with instances of the rarity of manuscripts, as it is shown in the anxiety to borrow them, and the conditions on which they were lent. We have already mentioned Richard of Bury. In his Philobiblion he devotes one entire chapter expressly to an enumeration of the conditions on which books were to be lent to strangers. In 1299, the Bishop of Winchester borrowed a Bible in two volumes folio, from a convent in that city, giving a bond drawn up in a most formal and solemn manner, for its due return. This Bible had been given to the convent by a former bishop, and in consideration of this gift, and 100 marks, the monks founded a daily mass for the soul of the donor. In the same century several Latin Bibles were given to the University of Oxford, on condition that the students who read them should deposit a cautionary pledge. And even after manuscripts were multiplied by the invention of linen paper, it was enacted by the statutes of St. Mary's College, at Oxford, in 1446, that "no scholar shall occupy a book in the library above one hour, or two hours at most, lest others should be hindered from the use of the same." Money was often lent on the deposit of a book; and there were public chests in the universities, and other places in which the books so deposited were kept. They were often particularly named and described in wills—generally left to a relation or friend, in fee, and for the term of his life, and afterwards to the library of some religious house. "When a book was bought," observes Mr. Warton, "the affair was of so much importance, that it was customary to assemble persons of consequence and character, and to make a formal record that they were present on the occasion." The same author adds, "Even so late as the year 1471, when Louis XI. of France borrowed the works of the Arabian physician Rhasis, from the faculty of medicine at Paris, he not only deposited, by way of pledge, a quantity of valuable plate, but was obliged to procure a nobleman to join with him as surety in a deed, by which he bound himself to return it under a considerable forfeiture." Long and violent altercations, and even lawsuits, sometimes took place in consequence of the disputed property of a book.

Books were so scarce in Spain in the tenth century, that several monasteries had among them only one copy of the Bible, of Jerome's Epistles, and of several other religious books; and monasteries had frequently only one missal. There are some curious instances given by Lupus, abbot of Ferrieris, of the extreme scarcity of *classical* manuscripts in the middle of the ninth century: he was much devoted to literature; and, from his letters, appears to have been indefatigable in his endeavours to find out such manuscripts, in order to borrow and copy them. In a letter to the Pope he earnestly requests of him a copy of Quintilian, and of a treatise of Cicero; for, he adds, though we have some fragments of them, a complete copy is not to be found in France. In two other of his letters, he requests of a brother abbot the loan of several manuscripts, which he assures him shall be copied and returned as soon as possible by a faithful messenger. Another time he sent a special messenger to borrow a manuscript, promising that he would take very great care of it, and return it by a safe opportunity, and requesting the person who lent it to him, if he were asked to whom he had lent it, to reply, to some near relations of his own, who had been very urgent to borrow it. Another manuscript, which he seems to have prized much, and a loan of which had been so frequently requested, that he thought of *banishing* it somewhere that it might not be destroyed or lost, he tells a friend he may perhaps lend him, when he comes to see him, but that he will not trust it to the messenger who had been sent for it, though a monk, and trustworthy, because he was travelling on foot. We shall extract only one more instance of the scarcity of manuscripts from the letters of Lupus:

he requests a friend to apply in his own name to an abbot of a monastery, to have a copy made of Suetonius; "for," he adds, "in this part of the world, the work is no where to be found."

We possess few facts respecting the price of manuscript books among the ancients. Plato, who seems to have spared no trouble or money in order to enrich his library, especially with philosophical works, paid a hundred minæ, equal to 375*l*., for three small treatises by Philolaus, the Pythagorean; and, after the death of Speusippus, Plato's disciple, his books were purchased by Aristotle; they were few in number; he paid for them three talents, about 675*l*. It is said that St. Jerome nearly ruined himself by the purchase of religious works alone. And, though, at this period, we have no specific prices of works, yet, from the account already given of their rarity, of the difficulty of ascertaining even where they were to be found, and of the extreme reluctance, in many instances, even to lend them, we may easily credit the general fact, that persons of a moderate fortune could not afford to purchase them, and that, by the rich even, they could seldom be procured without the payment of sums that required the sacrifice of some luxuries. The mere money paid for them, in the dark ages, whenever a person distinguished himself for his love of literature, was seldom the sole or the principal expense. It was often necessary to send to a great distance; to spend much time in finding out where they were. In the ninth century, an English bishop was obliged to make five journies to Rome, principally in order to purchase books; for one of his books thus procured, Alfred gave him an estate of eight hides of land, or as much land as eight ploughs could till. About the period of the invention of cotton paper, 1174, the homilies of St. Bede and St. Augustine's Psalter, were bought by a prior in Winchester, from the monks of Dorchester, in Oxfordshire, for twelve measures of barley, and a pall richly embroidered in silver. Stow informs us, that in 1274, a Bible, in nine volumes, fairly written, with a gloss or comment, sold for fifty marks, 33*l*. 6*s*. 8*d*.: about this time the price of wheat averaged about 3*s*. 4*d*. a quarter; a labourer's wages were 1½*d*. a day; a harvest man's, 2*d*. In a blank page of Comestor's Scholastic History, deposited in the British Museum, it is stated, that this MS. was taken from the King of France, at the battle of Poictiers: it was afterwards purchased by the Earl of Salisbury for a hundred marks, and directed, by the last will of his Countess, to be sold for forty livres. One hundred marks were equivalent to 66*l*. 13*s*. 4*d*. This sum was exactly the pay of Henry Percy, keeper of Berwick Castle, in 1359; at this time the king's surgeon's pay was 5*l*. 13*s*. 4*d*. per annum, and one shilling a day beside. Master carpenters had four-pence a day, their servants two-pence; the price of wheat about 6*s*. 8*d*. a quarter. At the beginning of the century, some books were bequeathed to Merton College, Oxford, of which the following are the names and valuation: A Scholastic History, 20*s*.; a Concordantia, 10*s*.; the four greater Prophets, with glosses, 5*s*.; a Psalter, with glosses, 10*s*.; St. Austin, on Genesis, 10*s*. About the year 1400, a copy of the Roman de la Rou was sold before the palace gate at Paris, for forty crowns, or 33*l*. 6*s*. 6*d*. The Countess of Anjou paid for a copy of the Homilies of Bishop Haiman, two hundred sheep, five quarters of wheat, five quarters of barley, and five quarters of millet. On the conquest of Paris, in 1425, the Duke of Bedford sent the royal library to England: it consisted of only eight hundred and fifty-three volumes, but it was valued at two thousand two hundred and twenty-three livres, rather more than the same number of pounds sterling. At this time the price of a cow was about 8*s*., of a horse about 20*s*. And the pension paid by the English Government to the Earl of Wallachia, who had been driven out of his territories by the Turks, was 26*l*. 13*s*. 4*d*. per annum. This library is thought to have formed the foundation of the celebrated library of Humphrey Duke of Gloucester. This nobleman was one of the most zealous and liberal patrons of literature and learned men of his age; he invited learned foreigners into England, whom he retained in his service, employing them in copying and translating from Greek into Latin; and he had constantly persons in his pay collecting valuable manuscripts for him. He gave to the University of Oxford, about the year 1440, six hundred volumes, one hundred and twenty of which alone were valued at more than 1000*l*. Wheat about this period might be exported, when not above 6*s*. 8*d*. a quarter. In the middle of this century,

a nobleman of Bologne, desirous of purchasing a copy of Livy, which had been transcribed by the celebrated Poggio, was obliged to sell an estate for this purpose, and with the purchase money, Poggio bought another estate, near Florence. Archbishop Usher tells us, from the Register of William Alnwick, Bishop of Norwich, that in 1429, the price of one of Wickliffe's English New Testaments, was four marks and forty pence, or 2*l.* 16*s.* 8*d.*, which, the Archishop observed, "is as much as will now (about 1630) buy forty new Testaments." Afterwards copies were multiplied so much, in consequence of the increase of Wickliffe's disciples, that the price fell to 20*s.*, when the price of a Porteus or breviary was six marks. In 1468, 1*l.* 6*s.* 8*d.* was lent on the security of a MS. of Petrus Comestor (a work already mentioned), deposited as a pledge. Wheat at this time was 6*s.* 8*d.* a quarter; beef, 10*s.* the carcase; mutton, 1*s.* 4*d.*; veal, 2*s.* 6*d.*; pork, 2*s.*; ale, 1¼*d.* a gallon. When Faust sold his Bibles at Paris (about 1460), the price of a parchment copy was reduced from four or five hundred to sixty, fifty, and forty crowns*. Other instances might be given of the extreme rarity and enormous price of books, in every country, and at all periods, previous to the invention of printing: but these are amply sufficient to prove the facilities which that discovery has given to the spread of literature and science, by removing this most serious and formidable impediment.

Had not sovereigns and rich individuals formed libraries to which men of learning had access, knowledge could not have advanced, even in the very slow manner in which it did; as they, in general, were too poor to purchase books, and had not sufficient leisure to find out where they were to be bought, or, while dispersed, where they were to be met with. The most celebrated libraries in ancient times, which may fairly be regarded as having contained a very large portion of the books then existing, were, 1. The Alexandrian Library founded by Ptolemy Soter, who reigned about 300 B. C. His successors enlarged it; one of them seized all books imported into Egypt, giving copies of them, made by his orders, and at his expense, to the proprietors: in a similar manner he got from the Athenians, the originals of Æschylus, Sophocles, and Euripides, returning them only copies, and giving them fifteen talents in exchange, upwards of £3000. This library suffered much during the first Alexandrine war; and was afterwards totally destroyed by the Calif Omar in A. D. 642. 2. The library founded by Pisistratus at Athens. This and the other libraries of this city, continued to flourish till after the time of Justinian. 3. Julius Cæsar projected a library at Rome, which was to be, strictly speaking, public; but his assassination frustrated the design: and the first public library was erected by Asinius Pollio, in the reign of Augustus. This emperor also founded two public libraries, the Octavian and the Palatine —the latter survived till the time of Gregory the Great, about the end of the sixth century. 4. But the most extensive and splendid of the libraries at Rome, was the Ulpian, founded by Trajan: it is believed that, at the suggestion of Pliny the younger, this emperor commanded all the books that were found in the conquered cities to be placed in this library. Most of the principal cities throughout the Roman empire, at this time, had public libraries. The desolation of the western empire by the barbarians destroyed or dispersed most of the books in them, so that, in this part of the world, after this period, and during the dark ages, monasteries almost exclusively possessed libraries. In the eastern empire it was different: both Constantinople and Alexandria preserved theirs, till the Turks obtained possession of these cities. The library of the former was founded by Constantine, and enlarged by succeeding emperors, especially by Julian and Theodosius the younger.

Dr. Henry, after mentioning Alfred's purchase of one book, for an estate of eight hides of land, observes—"At this rate none but kings, bishops, and abbots, could be possessed of any books: which is the reason that there were then no schools but in kings' palaces, bishops' sees, or monasteries!" It is generally believed that there were no public schools

* The supplying of books for divine service—Missal—Porteus, or Breviary—Manual, &c. originally fell upon the rector; as they were all written, and some of them beautifully illuminated, it was a very expensive duty. On the institution of vicars, the parishioners agreed to supply some of the books: Among them were the Antiphoners, two of which, in 1424, cost twenty-six marks, or 17*l.* 6*s.* 8*d.* The vicars were at the expense of binding and preserving the books; also of finding the Porteus; the price of this was about five or six marks.

in Rome till three hundred years after its foundation; parents teaching their children the little they knew. Even after the establishment of schools, private education at home was common. The teachers were generally slaves or freed men; and a slave always accompanied the boys of rank to school, carrying a box, containing books, paper, tablets, and instruments for writing. In learning their letters they were instructed by another boy, or usher*. Homer was taught to the Greek boys, and Virgil to the Roman. They were moved to different schools, according to their proficiency: being taught to read and write in one, and arithmetic, by *calculi* or counters, in a separate school. The porticoes of temples were common places for schools. In an ancient bas-relief, published by Winkelman, the education of two children of rank is represented: one about twelve years old holds a double tablet, long, and fastened by a hinge. The master, half naked, like the ancient philosophers, holds a roll (volumen), and is addressing the child. Some of the table-books must have been large; for, in Plautus, a school-boy, seventeen years old, is represented as breaking his master's head with one. From the origin of monasteries till the close of the tenth century, there were no schools in Europe, except those belonging to monasteries or episcopal churches. At the beginning of the eleventh century, they were opened in most of the cities of Italy and France, by qualified persons among both the laity and clergy. But though their general introduction and establishment must be assigned to this period, yet it is certain that Charlemagne founded several in his dominions; and long before his reign St. Augustin was an usher in a school. His business was to preside over the dress, morals, gait, &c., of his pupils, and to sit with them in a kind of anti-school, separated from the principal school by a curtain. Here they said their lessons to the usher, before they went to the master; when the curtain was drawn back. In the middle ages, there were distinct schools for clerks, for laymen, and for girls; and two hundred children at a time are represented as learning their letters. Itinerant schoolmasters were also common. The whole of the education, however, even of those of the highest ranks, seldom went beyond reading and writing, and the more simple rules of arithmetic. Parochial grammar schools, in villages, were established in the fifteenth century. The following account of their origin is given by Mr. Fosbroke: "To prevent the growth of Wickliffism, it had been made penal to put children to private teachers; and the consequent incessant influx to only a few schools, rendered, in 1447, grammar learning so low, that several clergymen in London petitioned parliament for leave to set up schools in their respective churches, in order to check seminaries, conducted by illiterate men. Thus commenced grammar schools, properly so called†."

* See Dodwell's Greece, for further proofs of a system of education in ancient Greece, similar to that of Bell and Lancaster. (Vol. ii. p. 37.)

† "It was not till the reign of Henry IV. (1399—1413) that villeins, farmers, and mechanics, were permitted, by law, to put their children to school (7 Henry IV. chap. 17;) and long after that they dared not to educate a son for the church, without a license from their lord."—(Henry's England, book v. chap. 4. sect. 1.)

## Chapter IV.

*Restorers of Literature, and Discoverers of Manuscripts, in the Middle Ages—First steps towards the Art of Printing—Invention of that Art—Early History—Introduction of it into the Kingdoms of Continental Europe.*

It is generally the fate of discoveries that are made prematurely, and under unfavourable circumstances, either to be strangled in their birth, or to struggle through a very short and useless existence. Had the art of printing been invented during the deepest ignorance and gloom of the dark ages, its value and importance would not have been appreciated, and it might gradually have sunk into neglect and total oblivion. Books were indeed excessively rare and dear; but very few sought for them, for few had the curiosity or ability to read, and fewer the money to purchase them. After the tenth century, literature began to revive; paper from linen rags was invented; a tendency to commerce appeared. This caused a gradual accumulation of capital, and rendered necessary some attention to learning. Then succeeded the agitation of men's minds, which preceded the Reformation, and which could not be set at rest but by reading and inquiry. The monks themselves, so far as they contributed to the perusal of legends and miraculous stories, were the unconscious instruments of that spreading desire for knowledge, which ushered in the in-

vention of printing, and which issued in the Reformation itself.

We have already named several individuals who, even in the darkest ages, spent much of their time or money, in endeavouring to discover and procure manuscripts. Long before the fall of Constantinople, the love of classical literature had been gradually reviving;—that event increased it, by compelling a great number of learned Greeks to seek a shelter in Italy. But it could not be gratified, till the manuscripts, which lay buried and neglected, were brought to light. As the labours of those who may justly be called the restorers of classical literature, were mainly instrumental in producing that state of things, which turned men's minds towards the invention of printing, and nourished it to maturity, when invented, we shall give a short account of the most celebrated of them, before we proceed to the invention itself.

Silvester II., before he became pope, which was in the last year of the tenth century, had been indefatigable in acquiring and communicating learning, and these qualities distinguished him during his whole life. In order to obtain a knowledge of the sciences and manuscripts, he visited Spain, and caused Italy, and the countries beyond the Alps, to be diligently explored. The Crusades interrupted the spread of literature; but in the fourteenth century, Petrarch roused his countrymen from their slumber—inspired a general love of literature—nourished and rewarded it by his own productions; and rescued the classics from the dungeons, where they had been hitherto shut up from the light and instruction of mankind. "He never passed an old convent, without searching its library, or knew of a friend travelling into those quarters, where he supposed books to be concealed, without entreaties to procure for him some classical manuscripts." Had not such a man appeared at this time, it is probable that most of the classical manuscripts would have been totally lost; so that in this case, he might have excited among his countrymen the love of literature, without being able to gratify or nourish it. Boccaccio, who shares with Petrarch the glory of having enriched the Italian language with its most perfect beauties, at the very moment when it may be said to have begun to exist, shares also with him the glory of being a zealous and successful restorer of classical manuscripts and literature. No man, during the first half of the fifteenth century, devoted himself with so much industry to this search, or made so good a use of them, when discovered, as Poggio. No difficulty, no want of assistance, no expense or labour discouraged him. His youth was spent in travelling to attain what seemed to be the sole object of his life; and when he became secretary to the Popes, eight of whom employed him in succession, he used the influence and opportunities his situation gave him, for the promotion of literature and the collecting of manuscripts at Rome. To these names we shall add only those of the Medici family; Emanuel Chrysolas, who was one of the first who introduced a knowledge of the Greek language and literature into Italy; and Theodore Gaza.

Europe seemed now ripe for the art of printing, and to require it. Persons of high rank felt a more general and powerful love of literature than they had ever experienced before. The minds of the great mass of the people too were now beginning to work; but materials were wanting on which they might work and by which they might work. At this important crisis, the art of printing was discovered, and an impulse given to knowledge which now no power, no conceivable combination of circumstances can possibly destroy.

Playing-cards, which were known and used in Germany at the very beginning of the fourteenth century, were first painted; but towards the end of that century a method of printing them by blocks was discovered. This was the first step towards the art of printing. The manufacturers of playing-cards naturally turned this discovery of printing from blocks to advantage and profit by engraving the images of saints—for which there was a regular and great demand—on wood. This may be considered as the second step. Books of Images were of two kinds: those without any text, and those with text; but even in the first words and sentences are interspersed. A wood cut of St. Christopher, the oldest known of the first kind, is now in the collection of Earl Spencer: at the foot of it are three short sentences, engraved and printed together with the figure, with the date 1423. The most celebrated of the books of images without text is the Biblia Pauperum. It consists of forty plates of figures and images, with sentences relating to them, the whole engraven on wood on one side of the paper. It seems to be a kind

of catechism of the Bible, and was sold at a low price to young persons and the common people; it has no date. Another work, a system of artificial memory, engraven on wood, in the same manner as the Biblia Pauperum, has the text separate from the figures; fifteen plates of each. The characters are very large, resembling those on ancient monuments. But, " of all the ancient books of images," observes Mr. Horne, " which preceded the invention of printing, the Speculum Salutis is confessedly the most perfect both in its design and execution." It is a collection of historical passages from the Scriptures, with a few from profane history. It was very popular, frequently reprinted, and translated into German, Flemish, and other languages.

The change and improvement from the manner in which these books of images were executed to moveable wooden characters, seems obvious and not difficult; but there is no evidence that these were ever used, except in the capital letters of some early printed books. It has been, indeed, contended strenuously by several antiquarians, that Lewis Coster, of Haarlem, invented and used them; that he, therefore, was the original inventor of the art of printing, and that Haarlem was the place where the invention was first put into practice. But it is now proved, that this opinion is without foundation; that wooden types were never used; that the claims of Coster of Haarlem cannot stand the test of accurate investigation; and that the art of printing, as at present practised, with moveable metal types, was discovered by John Guthenberg, of Mayence, about the year 1438.

Three years before this, Guthenberg entered into a partnership with three citizens of Strasburg, binding himself to disclose a secret which would enrich them all. One of the partners dying, and some of the most important implements having been stolen from the workshop, a lawsuit took place. In the course of this lawsuit, five witnesses, among whom was Guthenberg's confidential servant, proved that he (Guthenberg) was the first who practised the art of printing with moveable types. The result was a dissolution of partnership. The whole proceedings on this trial are in existence, and have been published in the original German.

After this, Guthenberg returned, poor and disappointed, but not dispirited, to his native city, Mayence. It is doubtful whether he had hitherto really printed any thing. Heinecken, who has investigated this subject with great diligence and labour, is of opinion that he had ruined both himself and his partners, without being able to produce a single clean and legible leaf. However that may be, in 1450, he entered into partnership at Mayence, with John Fust; they seem at first to have gone back to wooden blocks, and then to have tried moveable wooden letters and moveable metal ones, formed with a knife: all without effect. This partnership was also unfortunate; for, in consequence of the great expense incurred by Fust (who supplied the capital), in printing a Latin Bible, he commenced a suit against Guthenberg; the latter was obliged to give up his apparatus to Fust. It is not certain whether, during their partnership, they found out the art of casting characters in metal, which they had previously been obliged to cut with the hand; or whether this great improvement was made by Schoeffer, an ingenious man, who assisted them at this time, and was afterwards taken into partnership by Fust. The general opinion is, that the idea of punches and matrices for casting metal types originated with Schoeffer. He certainly improved this method, by rendering it more certain, easy, and expeditious.

Guthenberg, not discouraged by this second misfortune, established a new printing office, until 1465, when he obtained a situation, with a good salary, under the Elector Adolphus. In the mean time, Fust, in conjunction with Schoeffer, continued printing. In August, 1457, they published a beautiful edition of the Psalms; one of the earliest books yet discovered which has the name of the place and printers, with the date annexed. In 1462, the city of Mayence was taken by the Elector Adolphus, when the partners suffered much; and their workmen dispersing themselves, the art of printing was thus spread over Europe. Their masters, however, still carried on the business in Mayence. Fust's name appears to a Treatise of Cicero printed in 1466; all subsequent books have Schoeffer's name alone; he continued to print till his death in 1502, when he was succeeded by his son*.

* In order to give a clearer idea of the progress of the art in its infancy, we shall subjoin short notices of some of the works executed by Guthenberg and his partners. The two earliest works are supposed to be an alphabet, engraved on a plate for the use of schools, and some doctrinal tracts. Then followed two editions of Donatus on the parts of speech: the first from wooden blocks, which are still in the Royal Library of Paris; the second with moveable types

The date and cause of the dispersion of Fust and Schoeffer's workmen, and the consequent spreading of the art of printing over the continent of Europe, have been already stated. The respective periods of its first introduction into the principal continental kingdoms, together with some interesting anecdotes, we shall now mention. The first book printed at Rome was Cicero's Letters to his friend, in 1457. The printers were Conrad Sweynheim, and Arnold Pannartz. They left Germany for Italy in 1465, having served their apprenticeship to Fust and his partner. At first they settled at the monastery of Lubeaco, in the neighbourhood of Rome, where they printed the works of Lactantius, being encouraged and assisted by the monks, who were Benedictines, and very rich and learned. On their removal to Rome they were equally patronised by John Andreas the Pope's librarian. He not only supplied them with the most valuable manuscripts from the Vatican, but prepared the copy, corrected the proofs, prefixed dedications, prefaces, &c. Notwithstanding the encouragement they met with, they were obliged to petition the Pope for relief and assistance in 1472, having printed during the seven previous years, twenty-eight different works, some of them very large and expensive, the impressions of which amounted to 12,475 volumes. In this petition, after stating that they were the first who introduced this art into his holiness' territories, and the number of volumes printed by them, they added that their house was full of books in quires, but destitute of the necessaries of life. As they contrived to print for some time afterwards, it is supposed that assistance was granted them.

The first book printed at Venice was also Cicero's Epistles; the printer, John de Spira, the date 1469. He and his brother, also a printer, natives of Germany, surpassed all their predecessors in the beauty of their types and the elegance of their impressions; they employed two very learned men as correctors of their press. The Spiras were the first who applied the art on a regular and extensive scale to the publication of the classics. By an order of the senate, 1469, the exclusive privilege of printing the letters of Cicero and Pliny was granted to them for five years, in consequence of the beauty of their impressions. Venice became celebrated for its types, and supplied the printers of Rome with them. One of the best printers of the fifteenth century was settled at Nuremberg, his name was Coburger; he was styled by his contemporaries the prince of booksellers and printers: he employed daily twenty-four presses and one hundred men, besides furnishing work to the printers of Basle, Paris, and Lyons. His books, which relate chiefly to the canon law and theology, are distinguished for the blackness of the ink, and the squareness and fineness of the type, as well as the good quality of the paper, and the excellence of the press-work.

The first work from the Paris press is dated 1470; the printers were three Germans from Colmar. On the establishment of their office, the copyists, finding their business much injured, presented a memorial to the parliament; but Lewis XI. interfered in their behalf.

Lewis, who, amidst all his faults, was an encourager of literature, is said to have sent Nicolas Jenson, a native of France, to Mayence, to learn the art of printing, in 1470. But, owing to civil dissensions in his kingdom, Jenson settled at Venice, where he printed from

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on vellum. The celebrated first edition of the Bible from metal types; remarkable for the texture of the paper, excellence of execution, and blackness and lustre of the ink; supposed to have been printed in 1455. The expense of printing it gave rise to the lawsuit between Guthenberg and Fust. Like all other very ancient printed books, it has no title or paging, and many of the initial letters are painted by illumination. In 1456, Guthenberg printed an almanack, the first ever printed, and the very first book with a certain date. In 1457, Fust and Schoeffer printed their celebrated Psalter. In a colophon, (the sentence frequently added at the conclusion of a work by the early printers,) the invention of the art of printing is announced to the public in boasting, though by no means unreasonable or unwarranted terms. This Psalter is printed on vellum; the psalms in larger letters than the hymns, all uncommonly black. The capital letters are cut in wood; the largest of these, which are black, red, and blue, it is supposed must have passed three times through the press. Not more than six or seven copies are known to be in existence. The first edition of the Latin Bible, with a date, at Mayence, by Fust and Schoeffer, in 1462. Fust sold by himself, or by his agents, copies of this Bible at Paris, as manuscript, and supplied them so regularly and abundantly as to lower the price. From the facility with which he supplied them, and the uniformity of the copies, he was taken up as a necromancer; hence arose the story of the Devil and Dr. Faustus. The books were seized either on this occasion, or afterwards, in virtue of the *droit d'aubaine*, on the death of his agent, but they were restored by order of Louis XI. In 1465 Fust and Schoeffer published an edition of Cicero's Offices, "the first tribute of the new art to polite literature." After the death of Fust, about 1466, Schoeffer carried on the printing business alone for thirty-five or thirty-six years, in the course of which period he executed a great many works. By far the most important of these was an edition of Justinian's Institutes, the date is not known. In 1484 he printed an Herbal in 4to., with figures of plants; and in 1485, a folio edition of it. In 1490 he printed a third edition of the Mentz Psalter. In the preceding editions the full chant was written, in this it is printed. Schoeffer terminated his labours by a fourth edition of the Psalter in 1502.

1470 to 1480. He introduced great improvements; planning and reducing to their present proportions the characters called *roman*, so that his works are justly deemed very highly finished in every respect.

The first book printed at Naples, was in 1471. Two years afterwards, printing was introduced into Buda, in Hungary. The first work printed at Basle, in Switzerland, is dated 1474. The same year appeared a book, printed by the monks of a convent in the Rhingau. They were of the Augustine order, and by their rules, they were obliged to copy the works of the Fathers and ecclesiastical writers as part of their regular duty, and likewise as their chief means of subsistence. The discovery of printing having deprived them of these means, they immediately applied themselves to learn and practise that art, and were thus enabled at the same time to support themselves and fulfil the spirit of their rule.

The first work printed in Bohemia is dated 1476, but the printer's name is not known. John Snell, a German printer, invited into Sweden by the administrator Stein Sture, printed the first book in that kingdom in 1483. John Mathison, a Swede, who was patronised by the Bishop of Holun in Iceland, introduced the art of printing into that remote and desolate island, in the year 1531. The first book printed in Portugal is dated 1489; it is a commentary on the Pentateuch in Hebrew, and from the printers' names, they appear to have been Jews.

In 1493 the art was introduced into Denmark, when a grammatical treatise was published. The first treatise relating to commerce seems to have been published at Provins, in 1496. Three years afterwards the Catholicon was printed in Bretagne, or Breton, French, and Latin.

The first work printed in Moravia, is dated 1500: it is a treatise against the Waldenses. In 1560, a Russian merchant, having bought a quantity of types, printing press, &c., introduced the art into Moscow. The mob, however, at the instigation, it is supposed, of the priests, destroyed the office, press, and types.

The most early printed books were principally of the folio and quarto size. In 1465 the old Gothic character was changed for a kind of semi-Gothic, in the Lactantius, printed at Lubeaco. The roman type was first used at Rome in 1467, and soon afterwards brought to perfection by Nicolas Jenson. The celebrated printer, Aldus Manutius, introduced towards the end of the fifteenth century, the *italic*. Aldus was extremely careful in correcting his proofs, so that he never printed more than two sheets a week. He printed a great number of Latin and Italian books in 8vo., which are executed with great elegance and correctness. In the edition of Cicero, printed at Mayence, 1465, a few sentences in Greek types are given. The same year, Sweynheim and Pannartz, having procured a very small quantity of Greek types, began to print the Lactantius, already mentioned; before the work was completed, however, they seem to have procured a further supply, for in the first part of the work a blank is left wherever a long sentence occurs, whereas, after the middle of the work, all the Greek quotations are printed. The first book, entirely Greek, is supposed to be the Greek grammar of Lascaris, printed at Milan in 1476. Aldus, in addition to his other merits, is justly celebrated for having first produced beautiful and correct editions of Greek works. Printing in Hebrew was first executed by Soncino, in Milan, in 1482. The Pentateuch was printed there this year. The first Polyglott bible, in Hebrew, Arabic, Chaldee, Greek, and Latin, was printed at Genoa in 1516, by Pormo. Aldus seems to have planned, and even to have begun to execute, a Polyglott bible, in Hebrew, Greek, and Latin. There is one specimen page, in folio, preserved in the Royal Library at Paris.

Till 1476 or 1480, the titles of books were printed on separate leaves. In the infancy of the art, blanks were left for initial letters, which were afterwards filled up by the illuminators; but this trade did not long survive the invention of printing. Divisions into sentences were seldom made; the orthography varied much; punctuation was confined to the colon, period, and an oblique stroke. This is supposed to have arisen from a desire to imitate manuscripts as near as possible. Aldus added the semicolon; notes of interrogation and admiration were not used till long afterwards. The paper was very thick and solid; this, and the frequent use of vellum, were the result of the desire to imitate manuscripts. It is known, besides, that at that period the disproportion between the price of paper and vellum was not nearly so great as at present. Very early printed books are also dis-

tinguished by their numerous and difficult abbreviations, by the absence of signatures and catch-words, and of the printer's name, place, and date; when inserted, they are at the end of the book. Signatures, however, were used in 1472 and 1474; and catch-words, which appear in manuscripts of the eleventh century, were first used in printing, by Spira, at Venice, about the same time. They are at present little used, either on the continent or in Britain.

## Chapter V.

### *Life of* William Caxton.

William Caxton was born in the Weald of Kent, as he himself tells us; in what part of it, and in what year, is not known, but it is supposed about the year 1412. Of the rank or employment of his parents we are entirely ignorant. His father came to London, and resided with his son, in Westminster, at the time of his greatest fame, as a printer. There he died at a very advanced age, in 1480. It may be presumed that his parents were in good circumstances from the education they gave him, and the business to which they put him. At this period learning of all kinds was at a much lower ebb in England than in most of the continental states of Europe; in consequence, principally, of the civil wars in which the nation was embroiled, the habits of restlessness thus produced, and the constant pre-occupation of men's time and thoughts in promoting the cause they espoused, and in protecting their lives and property. Under these circumstances the most plain and common education was often neglected. Caxton's parents, however, performed their duty to him: "I am bounden," he says, "to pray for my father and mother's souls, that, in my youth, sent me to school, by which, by the sufferance of God, I get my living, I hope truly." When he was about fifteen or sixteen, he was put apprentice to William Large, a considerable mercer, of the city of London, and afterwards sheriff and mayor. The name, *mercer*, was given at this time to general merchants, trading in all kinds of goods. After he had served his apprenticeship, Caxton took up his freedom in the Mercers' Company, and became a citizen of London. That he conducted himself, while an apprentice, to the satisfaction of his master, may be presumed from the circumstance, that he was left in his will, in 1441, a legacy of twenty marks, or 13*l*. 6*s*. 8*d*., a considerable sum in those days, when the usual price of wheat was 5*s*. 4*d*. a quarter; malt, 4*s*. the quarter; and a pair of plough oxen could be purchased for about 1*l*. 3*s*.

In what manner he employed himself from the expiration of his apprenticeship, till he went abroad, is not known; but that he did not go abroad till some years afterwards, a comparison of dates will render apparent. He was born about 1412; he could not have been more than sixteen when put apprentice; so that his apprenticeship of seven years must have expired in the year 1435. The opinion, therefore, that he went into the Low Countries on the termination of his apprenticeship is not correct, as he did not leave England till 1442, the year after he received the legacy.

In what capacity or for what purpose he left England, we are ignorant;—probably as a merchant, either on his own account, or as agent for some other merchant. He informs us that he continued for the most part in the countries of Brabant, Flanders, Holland, and Zealand,—all at this time belonging to the Duke of Burgundy, one of the most powerful princes in this part of Europe, whose friendship and alliance were anxiously sought for by the kings of France and England.

In the year 1464, he was appointed by Edward IV. ambassador, along with Richard Whetenhall, "to continue and confirm a treaty of commerce with Philip, Duke of Burgundy, or, if necessary, to form a new treaty." In the commission, which is given in Rymer's Fœdera, they are styled ambassadors and special deputies; and full powers to treat are given to either, or both of them. The Low Countries were at this period the great mart of Europe, in which were to be purchased, at all times, and in great abundance, the produce and manufactures of most parts of the world. Treaties of commerce between England and them were frequently made and broken; and it required not only considerable knowledge in commercial affairs, and in the relative commercial wants and advantages of the two countries, but also a sound judgment, and much circumspection and prudence, to make or renew them. Merchants seem to have been generally employed on these occasions; and we may reasonably conjecture that Caxton's character and experience,

as a merchant, and his long residence in the Netherlands, pointed him out as a fit person for this embassy.

Philip, Duke of Burgundy, was the most magnificent prince of his age: his court, one of the most polished; and his fondness for the expiring customs of chivalry, and for literature, equally great and influential. In the prologue to a book of the whole life of Jason, translated under the protection of King Edward, Caxton thus describes the chamber of this prince, in his castle of Hesdein, in Artois. It ought to be premised, that Philip had instituted the order of the Knights of the Golden Fleece. "But, well wote I, that the noble Duke Philip, first founder of this said order, did do maken a chamber in the castle of Hesdein, wherein was craftily and curiously depainted, the conquest of the Golden Fleece, by the said Jason; in which chamber I have been, and seen the said history so depainted; and in remembrance of Medea, and of her cunning and science, he had do make in the said chamber, by subtil engine, that, when he would, it should seem that it lightened, and after, thunder, snow, and rain, and all within the said chamber, as oftimes, and when it should please him, which was all made for his singular pleasure."

During his residence in the Low Countries he acquired or perfected his knowledge of the French language, gained some acquaintance with the Flemish or Dutch (as appears by his translation of Reynard the Fox from the latter); imbibed his taste for literature, and passion for romance, and made himself master of the art of printing, "at great charge and dispense," as he informs us. His passion for romance he most probably derived from his intimacy with Raoul le Fevre, chaplain to the Duke of Burgundy, and with Henry Boulonger, canon of Lausanne. The former of these persons was the author of the Romance of Jason, and of the Recueill of the Histories of Troy, both of which were afterwards translated and printed by Caxton; and at the instance of the latter he translated, compiled, and printed, 'The History and Lyf of the most Noble and Christian Prince Charles the Great, Kyng of Vienna and Emperor of Rome.'

In June, 1467, Philip Duke of Burgundy died, and was succeeded by his son, Charles. A treaty of marriage between this prince and Margaret, sister to Edward IV., was at this time negotiating, but was interrupted by the sudden death of Philip: the marriage, however, took place a year afterwards, on the 3d of June, 1468. Caxton was appointed to a situation in the household of the duchess, soon after her arrival in the Netherlands; but in what capacity, or with what salary, is not known. He seems, however, to have been on familiar terms with Margaret, and not to have been much occupied. For he informs us, that in 1469 he began translating the Histories of Troy, of his friend Raoul le Fevre, in Bruges, continued it at Ghent, and finished it at Cologne; he, however, laid the translation aside for some time. "In 1469," he says, "having no great charge or occupation, and wishing to eschew sloth and idleness—which is mother and nourisher of vices—having good leisure, being at Cologne, I set about finishing the translation. When, however, I remembered my simpleness and imperfections in French and English, I fell in despair of my works, and after I had written 5 or 6 quairs, purposed no more to have continued therein; and the quairs laid apart; and in two years after laboured no more in this work: till in a time it fortuned Lady Margaret sent for me to speak with her good Grace of divers matters, among the which I let her have knowledge of the foresaid beginning. "The Duchess," he adds, "found default in myne English, which she commanded me to amend, and to continue and make an end of the residue, which command I durst not disobey." The Duchess rewarded him liberally for his labour. In his prologue and epilogue to this work, he mentions that his eyes are dimmed with over much looking on the white paper; that his courage was not so prone and ready to labour as it had been; and that age was creeping on him daily, and enfeebling all his body;—that he had learnt and practised at great charge and dispense to ordain the said book in print; and not written with pen and ink, as other books be.

The translation of the Recueill was published at Cologne in 1471; but he had printed there, at least, two works before that; the original of the Recueill —a work unknown to German bibliographers— in 1464-7; and the oration of John Russel, on Charles, Duke of Burgundy, being created a knight of the garter in 1469. The existence of this was unknown till the year 1807, when it was discovered at the sale of Mr.

Brand's books. No other book printed by Caxton at Cologne has been discovered; but that he printed there Bartholomeus de Proprietatibus Rerum, is plain from Wynkyn de Worde. This successor of Caxton printed, in 1494, Trevisa's translation of Bartholomeus; and in his proeme he requests his readers "to remember the soul of William Caxton, first printer of this boke in Latin tongue at Cologne;" this is the only instance of Caxton's having printed a Latin work, and would seem to imply some knowledge of that language.

It is supposed, that he returned to England about the year 1472, and brought with him the unsold copies of the translation of the Recueill. His first patron was Thomas Milling, Bishop of Hereford, who held the abbotship of St. Peter's, Westminster, *in commendam*. Caxton took up his residence and established his printing-office, either in the immediate neighbourhood of the abbey, or in one of the chapels attached to it.

That Caxton introduced the art of printing into England, and first practised it here, was never doubted till the year 1642: a dispute arose, at this time, between the Company of Stationers and some persons, respecting a patent for printing; the case was formally argued; and in the course of the pleadings, Caxton was proved, incontestably, to have been the first printer in England. Soon after the Restoration, a book was discovered in the public library at Cambridge, the date of which was Oxford, 1468. The probability is, however, that the date of this book is incorrect, and that it should have been 1478, not 1468; this is inferred from its being printed with separate fusile metal types, very neat and beautiful, from the regularity of the page and the appearance of signatures; and, moreover, from the fact, that no other production issued from the Oxford press till eleven years after 1468, it being highly improbable that a press connected with a university should have continued so long unemployed. But, even granting that the date is accurate, and that the book was printed in 1468, six years before the execution of any work by Caxton, the merit of Caxton, and the obligations of this country to him, are but little lessened by this circumstance.

Frequent and unprofitable disputes have arisen, at different times, and on various occasions, respecting original discoveries and inventions. He, who first unfolds and demonstrates a grand and important principle, or, by his skill, penetration, and labour, succeeds in applying a known power to new purposes of benefit to mankind, may excite our admiration for his genius or his knowledge; but if, from the circumstances of the times, and men's minds not being ripe and prepared, or from a combination of untoward and unfavourable events, or from any other cause, dependent on himself or not, his discovery or invention, of whatever nature it may be, dies with him, or is barren and unproductive, without shedding its light or influence on his contemporaries and future ages, we must withhold from him our gratitude and sense of obligation, and reserve them for the man to whom we can trace the benefits we enjoy.

The common opinion is, that the 'Game of Chess' was the first book printed by Caxton at Westminster: Mr. Dibdin, however, thinks it more probable that the Romance of Jason was the earliest specimen of his press in England. These are supposed to have been printed in 1474; this date is, indeed, specified in the 'Game of Chess,' but it is doubtful whether it signifies the year when it was written, or that in which it was printed. This book was dedicated to George Duke of Clarence, the oldest surviving brother of King Edward. Caxton enjoyed the patronage of Henry VII., and his son, Prince Arthur, as well as of Edward and his brother; some of the nobility also encouraged him. Whether their patronage and encouragement displayed themselves in a substantial and profitable manner, we do not learn, but he himself was indefatigable in cultivating this new art. Besides the labour necessarily attached to his press, he translated not fewer than five thousand closely printed folio pages, though well stricken in years. From the colophon of Wynkyn de Worde's edition of the Vitas Patrum, 1495, it appears that this book was translated out of French into English by William Caxton, of Westminster, late dead, and that he finished it "at the last day of his life." The productions of his press amount to sixty-four. Of the most interesting of these works, either from the anecdotes connected with them, from the insight they give into his life and character, or into the manner of the times, or from the specimens they afford of his talents and information, we shall give a short account, arranging them in chronological order.

'Dictes and Sayings of the Philosophers.' This is the first book
1477. printed by Caxton with the year and place specified. It was translated from the French by Antony Woodville, Earl of Rivers. This nobleman had left out some strictures on women, which were in the original French; these Caxton translated and added as an appendix in three additional leaves; of his reasons for doing so, he gives the following statement. Lord Rivers had desired him to look over the translation, and to correct it. Caxton observed that the Dictes of Socrates on Women were not there, and indulged in many conjectures respecting the reason of their omission. He supposed that some fair lady had used her influence with his lordship, or that he was courting some fair lady at the time, or that he thought Socrates said more than what was true, or that these Dictes were not in his lordship's copy: "or else peradventure that the wind had blown over the leaf at the time of the translation." As, however, his lordship had given him permission to correct the translation, Caxton thought he should not be going beyond due limits if he added these Dictes. But, he tells us, "I did not presume to put and set them in my said lord's book, but in the end apart, in the rehearsal of the works, that Lord Rivers, or any other person, if they be not pleased, may with a pen erase it, or else rend the leaf out of the book, humbly beseeching my said lord to take no displeasure on me so presuming." He then requests the reader to lay the blame on Socrates, not on him.* From his insertion of these strictures on women, which are not the most courtly, it has been inferred that he was a womanhater; but that he was not so, appears from some of his prologues, especially from that to the 'Knight of the Tower.' This work he was requested to translate and print by "a noble lady, who had brought forth many noble and fair daughters, which were virtuously nourished and learned."

'The Moral Proverbs of Christina, of Pisa.' The same year Caxton
1478. began to print a work called 'Cordyael,' but he did not finish printing it, or at least it was not published till 1480. It does not appear that any other work came from his press during this interval. These two books were also translations from the French, by Caxton's patron, Lord Rivers. Of the political life of this accomplished and amiable nobleman, who was one of the very few who, in that age, promoted the cause of literature in this country,—this is not the place to speak: his dreadful catastrophe is well known.

"Rivers, Vaughan, and Gray,
Ere this, lie shorter by the head at Pomfret."

Caxton gives the following account of him and his works. "The noble and virtuous Lord Anthoine, Earl Rivers, Lord Scales and of the Isle of Wight, under governor to my Lord Prince of Wales, notwithstanding the great labour and charge that he hath had in the service of the King and of the said Lord Prince, as well in Wales as in England, which hath be to him no little thought and business both in sprite and body, as the fruit thereof experimentely sheweth; yet, over that, t' enrich his virtuous disposicion, he hath put him in devoyr, at all times, when he might have a leisure, which was but startmele, to translate divers works out of French into English. Among other passed through myn hand, the book of the Wise Sayings or Dictes of Philosophers, and the wise holsom Proverbs of Christine of Pisa, set in metre. Over that, he hath made divers balads agenst the seven dedly synnes. Furthermore, he took upon him the translating of this present work, named Cordyale, trusting that both the reders and the hearers thereof should know themself hereafter the better, and amend their lyving." These ballads are supposed to be lost; but John Rouse, of Warwick, a contemporary historian, has preserved a short poem of the Earl. Rouse seems to have copied it from his handwriting; it was written during his confinement in Pomfret Castle, a short time before his death in 1483; and, as Dr. Percy justly remarks, "gives us a fine picture of the composure and steadiness with which this stout Earl beheld his approaching fate."*

In this year (1480) also, Caxton printed his Chronicle, and his Description of Britain which is usually subjoined to it. These were very popular, having been reprinted four times *in this century*, (twice, however, without the Description;) and seven times *in the sixteenth century*.

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* A manuscript of Lord Rivers's translation of this work, with an illumination representing him introducing Caxton to Edward IV., his queen, and the prince, is preserved in the Archbishop of Canterbury's Library, at Lambeth Palace.

* It is printed in Percy's Reliques of Ancient English Poetry, vol. ii. p. 44; and in Ritson's Ancient Songs, p. 87.

'The Mirror of the World,' 'Reynard the Fox,' from the Dutch, 'Tully
1481. on Old Age,' 'Tully on Friendship,' and 'Godfrey of Boulogne,' appeared this year. The two Treatises of Tully were translated by John Tiptoft, Earl of Worcester*.

This year Caxton published the 'Polychronicon,' from the English ver-
1482. sion of John of Trevisa, who translated it from the Latin of Higden. It is a large volume, and seems to have been intended by Caxton as a helpmate to his Chronicle. The printing must have occupied him the whole year, as no other publication came from his press in 1482. Besides printing it, however, he added an eighth book, bringing the history down from 1357 to 1460; "because," he says, "men, whiles in this time ben oblivious and lightly forgotten, many things deygne to be put in memory; and also there cannot be founden in these days but few that wryte in their regysters such things as daily happen and fall." He was also obliged to take the trouble of altering many parts of Trevisa's language; for, though only 124 years had elapsed, many words were quite obsolete and unintelligible. This, Caxton particularly notices in the 'Polychronicon;' and at greater length in the following curious passage in the preface to his 'Eneid,' a work from his press, that will be afterwards noticed.

"After divers works, made, translated, and atchieved, having no work in hand, I, sitting in my study, where as lay many divers pamphlets and books, it happened that to my hand came a little book, in French, which late was translated out of Latin, by some noble clerk of France, which book is named 'Eneid,' as made in Latin by that noble person and great clerk, Virgil, which book I saw over, and read therein. (He then describes the contents.) In which book I had great pleasure by cause of the fair and honest terms, and words, in French, which I never saw tofore like, ne none so pleasant nor so well ordered: which book as me seemed should be much requisite to noble men to see, as well for the eloquence as histories; and when I had advised me in this said book, I deliberated, and concluded to translate it into English, and forthwith took a pen and ink, and wrote a leaf or twain, which I oversaw again, to correct it; and when I saw the fair and strange terms therein, I doubted that it should not please some gentlemen, which late blamed me, saying, that in my translations, I had over curious terms, which could not be understand of common people; and desired me to use old and homely terms in my translations; and fain would I satisfy every man, and so to do, took an old book, and read therein; and certainly the English was so rude and broad, that I could not well understand it; and also, my Lord Abbot of Westminster, did do shew to me late certain evidences, written in old English, for to reduce it into our English, now used; and certainly it was written in such wise, that was more like to Dutch than to English. I could not reduce, nor bring it to be understanden."

Again: "Certainly the language now used varieth far from that which was used and spoken when I was born; for we, Englishmen, been borne under the dominacion of the moone, which is never stedfaste, but ever wavering." In his time, the inhabitants of one county hardly understood those of another: "The most quantity of the people understand not Latin nor French, in this royaume of England." The intermixture of French words and idioms, of course, was most prevalent in the capital. "That common English, that is spoken in one shyre varyeth from another—in so much that in my dayes happened, that certain merchants were in a ship, in Thamys, for to have sailed over the sea to Zealand; and, for lack of wind, they tarried att Forland, and went to land for to refresh them; and one of them, named Sheffield, a mercer, came

* This nobleman possessed great talents, received an excellent education, and devoted his purse and leisure time to the purchase of books, and the promotion and encouragement of literature. Horace Walpole remarks, that whatever disputes there may be about his titles in the state, there is no doubt but he was anciently at the head of literature, and so masterly an orator, that he drew tears from the eyes of Pope Pius II. (the celebrated Eneas Sylvius) when he visited Rome, through a curiosity of seeing the Vatican Library. (On his return to England, he presented books to the Library at Oxford, which had cost him 500 marks, upwards of 330*l*.—a large sum at this period.) His fondness for literature, and perhaps his political opinions, both being zealous Yorkists, brought him acquainted with Caxton. When Edward IV. was obliged to abandon his kingdom in order to save his life, in October, 1470, the Earl of Worcester was taken and beheaded on Tower hill, on the 15th of that month. Caxton speaks in warm and affectionate language of him. "In his time," he says, "he flowered in vertue and cunning, and to whom he knew none lyke among the Lords of the Temporalty in science and moral vertue." Again: "O, good blessed Lord God! what grete loss was it of that noble, vertuous, and well-disposed lord; and what worship had he at Rome in the presence of our holy fader, the Pope; and so in all other places unto his deth; at which deth, every man that was there might lern to die, and take his deth patientlye."

into an hous, and axed for mete, and especially he axed after egges; and the good wyfe answerde, that she could speke no Frenche, and the merchant was angry, for he also could speke no Frenche, but would have had egges, and she understood him not. And then at last another sayd, that he would have eyrun. Then the good wyfe sayd, that she understood him well*." Caxton seems to have been a good deal puzzled and perplexed about the language he should use in his translations; for, while some advised him to use old and homely terms: "Some honest and great clerks," he adds, "have been with me, and desired me to write the most curious terms that I could finde—and thus, betwixt plain, rude, and curious, I stand abashed." There can be no doubt, however, that either by following the advice of those honest and great clerks, or from his long residence abroad—in his translations, as Dr. Johnson observes, 'the original is so scrupulously followed, that they afford us little knowledge of our own language; though the words are English, the phrase is foreign."

Caxton printed more books this year, than in any other. Seven bear
1483. this date. Among them were 'Gawin's Confessio Amantis;' and the 'Golden Legend.' A very full and particular account of the former is given by Mr. Dibdin, in his 'Typographical Antiquities,' vol. i., p. 177—185. Caxton informs us, that the printing of the 'Golden Legend' made him "half desperate to have left it, and to have laid it apart;" but he took courage, and went on, when the Earl of Arundel promised to take a number of copies, and to send him "a buck in summer, and a doe in winter."

He printed four books, of which two were 'Æsop;' and the 'Order of
1484. Chivalry.' Mr. Dibdin, who has seen and examined more early editions of Æsop, in different languages, than most people, considers Caxton's edition, on the whole, as the rarest of all those in the fifteenth century. His Majesty's copy of it, he adds, is the only perfect one known. In the 'Order of Chivalry,' which he translated out of French, he gives a curious picture of the manners of his age; and at the same time laments, in strong and feeling language, the decline of chivalry: "O! ye knights of England, where is the custom and usage of noble chivalry that was used in those days. What do you now, but go to the baynes (baths,) and play at dyse; and some, not well advysed, use not honest and good rule again all order of knighthode. Leve this—leve it! and read the noble volumes of St. Graal, of Lancelot, of Galaad, of Trystram, of Perseforest, of Percival, of Gavaine, and many more. There shall ye see manhode, curtsys, and gentleness. And look in latter days of the noble actes sith the Conquest; as in King Richard dayes, Cuer de Lion; Edward I. and III., and his noble sones; Syr Robert Knowles, &c. Rede Froissart. Also, behold that noble and victorious King Hary the Fifthe. I would demand a question, if I should not displese: How many knyghtes ben ther now in England, that have th' use and th' exercise of a knyghte. That is to wit, that he knoweth his horse, and his horse him. I suppose, an a due serche sholde be made, there sholde be many founden that lacke. The more pyte is. I would it pleased our soverayne lord, that twyse or thryce a year, or as the lest ones, he wold do cry justes of pies, to th' ende, that every knyghte sholde have hors and harneys, and also the use and craft of a knyghte; and also to tornay one against one, or two against two, and the best to have a prys—a diamond or jewels, such as should plese the prynce."

Caxton, probably, like most other persons when they become old, regarded the manners of youth as much worse than they were in his early days. We must make allowance for this failing, in reading his Picture of London, and its youthful inhabitants. "I have known it in my young age much more wealthy, prosperous and richer, than it is at this day; and the cause is, that there is almost none that intendeth to the commonweal, but only every man for his singular profit." And, in another place, "I see that the children that ben borne within the said citye encrease and proufitte not like their faders and olders: but for moste parte, after that they ben coming to their perfite years of discretion and ripeness of age, how well that their faders have left to them grete quantity of goods, yet scarcely amonge ten, two thryve. O blessed Lord, when I remember this I am all abashed; I can-

* If Caxton is correct in this story, the language of this part of Kent (in the weald of which, where he was born, he acknowledges English is spoken broad and rude) must have borrowed the word for egg from the Teutonic, and not from the Anglo-Saxon; *æg*, being the Anglo-Saxon, and *ei* the German, for an egg.

not juge the cause; but fayrer, ne wiser, ne bet bespoken children in theyre youth ben no wher then ther ben in London; but at their full ryping there is no carnel, no good corn founden, but chaffe for the most parte."

In 1485, his press was entirely occupied with romances. The first was 'Morte Arthur, the Liff of King Arthur of the Noble Knyghts of the Round Table, and in the end the dolorous Deth of them all.' This had been translated from the French, by Sir Thomas Mallery, knight; and Caxton printed it from the MS. It is a magnificent volume, and is supposed to have occupied him seven months. 2. The History of Charlemagne, already mentioned, as having been compiled and translated from two French books, by the advice of his friend Henry Boulonger, canon of Lausanne. Only one more was printed by him this year—'The Storye of the right noble, right valiant, and worthy Knight Parys;' this also he translated from the French. In the year 1486, his press seems to have been idle; at least none of his works bear this date: and in 1487, only one book appeared, entitled, 'The Book of Good Manners.' The original French, from which he translated it, he informs us, was given to him by a special friend of his, a mercer of London*. In 1488 no books appeared. In 1489 Caxton published four, of which 'The Fait of Armes and Chivalry' was one. "This was delivered to me, William Caxton, by the most Chrystin King and redoubted Prince, my natural and sovereign lord, Kyng Henry the 7th, Kyng of England and of France, in his palace of Westmestie, the 23 day of Janyure, the 4th yere of his regne; and desired and willed me to translate this said boke, and reduce it into our English and natural tongue, and to put it in imprynte." It is a compilation by Christine of Pisa, from the Military Treatises of Vegetius Frontinus, and the Arbre des Battailles. Another book printed this year was the 'Eneidos,' translated from the French; it is a mere compilation in prose of the principal events recorded in Virgil's poem, and has no pretension to an imitation of that poet, in any one respect. It does not, therefore, deserve the contemptuous and sarcastic notice taken of it, by Gawin Douglas, in the preface to his Scotch translation of Virgil. Caxton's work was dedicated to Arthur, eldest son of Henry VII. He represents himself as at this time well stricken in years: and if the date usually assigned to his birth (1412) be accurate, he must have been seventy-seven years old. The 'Doctrinne of Sapience,' also published in 1489, is the last that bears a date, if we except his edition of the Statutes: a perfect set of these, passed in the reign of Henry VII. till the death of Caxton (1490—1) have very recently been discovered. Twenty-eight of his known publications are without dates. Some of these have been already noticed; a few of the remainder will supply some interesting matter. Caxton printed Chaucer's Canterbury Tales twice; each edition is without date, but the first is supposed to have been one of the earliest productions of his press. Mr. Warton regards it as much more to his honour, than it can be to his discredit, that he printed them very incorrectly. "He probably took the first manuscript that he could procure to print from, and it happened unluckily to be one of the worst in all respects that he could possibly have met with." As soon, however, as he found out these imperfections and errors he began a second edition "for to satisfy the author, whereas tofore, by ignorance, I had erred in hurting and defamying his boke." Caxton's extreme and conscientious desire to fulfil one of the most important duties of an editor and printer, (and he acted as both,) by giving the works as the author himself wrote them, as well as his candour and ingenuousness, are depicted in a clear and interesting manner, in the preface to his second edition.

He seems to have had a veneration for the memory of this poet, and to have formed, with sound judgment and good taste, a most correct and precise estimate of the peculiar merits of his poetry. As a proof of the former, we may mention that Caxton, at his own expense, procured a long epitaph to be written in honour of Chaucer. This was inscribed on a tablet, hung on a pillar near the poet's grave in the south aisle of Westminster Abbey. The following remarks will amply justify what we have stated respecting Caxton's ability, fully to understand, and thoroughly to relish, the merits and beauties of Chaucer's poetry.

* The mercers of London seem to have been great encouragers of literature. Prefixed to Wynkyn de Worde's reprint of Caxton's 'Polichronicon' in 1495, there are a few poetical stanzas, in which one Roger Thoornye, a mercer, is praised for ordering and encouraging the printer to undertake so laborious a performance.

"We ought to give a singular laud unto that noble and great philosopher, Geoffrey Chaucer, the which, for his ornate writings in our tong, may well have the name of a laureate poet. For, to fore that he embellished and ornated and made fair our English, in this royaume was had rude speech and incongrue, as yet it appeareth by old books, which, at this day, ought not to have place, ne be compared among unto his beauteous volumes and ornate writings, of whom he made many books and treatises of many a noble history, as well in metre as in rhyme and prose: and then so craftily made, *that he comprehended his matters in short, quick, and high sentences, eschewing perplexity; casting away the chaff of superfluity, and shewing the picked grain of sentence, uttered by crafty and sugared eloquence.*"

And speaking of Chaucer's 'Book of Fame,' which he also printed, he says, "Which work, as me seemeth, is craftily made and digne to be written and known; for he toucheth in it right great wisdom and subtle understanding; *and so in all his works he excelleth, in mine opinion, all other writers in our English, for he writeth no void words, but all his matter is full of high and quick sentence, to whom ought to be given laud and praise for his noble making and writing.*"

Chaucer's translation of Boethius was also printed by Caxton, without date. It is alternately in Latin and English, but the former is not given entire; a few verses of a period in Latin being succeeded by the whole of the corresponding period in English, and so through the whole volume: the Latin type is large compared with the English.

A curious volume was printed by Caxton, about the period when the French, which had hitherto been spoken almost exclusively at court, was giving place to the English language; it is entitled the 'Book for Travellers.' It contains the corresponding terms in both languages, for those things most commonly talked of at court, especially such as relate to dress.

We have already stated that he continued his labours as a printer to the very last; he seems also to have taken an active part in the affairs of the parish of St. Margaret, Westminster, in which he lived and died; since, for some years before his death, his name appears to the churchwardens' accounts, as one of the parishioners who had undertaken to examine their details. He died in 1490—1, was buried in St. Margaret's, and left some books to that church.

His character may be collected from the account we have given of his labours, and the extracts we have made from his prefaces; he was possessed of good sense and sound judgment; steady, persevering, active, zealous and liberal in his services for that important art which he introduced into this kingdom; labouring not only as a printer, but as translator and editor. It has been objected that he was too much given to admire and print romances; but in this he only partook of the spirit of the age; perhaps, indeed, it survived in him longer and with more power, than in most of his contemporaries; but that his love of romance did not blunt his judgment and taste for real talent is evident by his printing Chaucer's works, and his criticisms on them. It should be recollected, also, that in the selection of works for the press he was necessarily guided by public opinion, and by the probability that what he did print would repay him for his labour and expense. The remarks of Gibbon on this point are sensible and candid. "In the choice of his authors, that liberal and industrious artist was reduced to comply with the vicious taste of his readers, to gratify the nobles with treatises of heraldry, hawking, and the game of chess, and to amuse the popular credulity with romances of fabulous knights, and legends of more fabulous saints. The father of printing expresses a laudable desire to elucidate the history of his country, but instead of publishing the Latin Chronicle of Ralph Higden, he could only venture on the English version by John de Trevisa; and his complaint of the difficulty of finding materials for his own continuation of that work, sufficiently attests, that even the writers which we now possess of the fourteenth and fifteenth centuries, had not yet emerged from the darkness of the cloister." If we reflect, too, on the state of England at this period, that he established his press soon after the murder of Henry VI., and that he carried on his works during the remainder of the reign of Edward IV., and the reigns of Edward V. and Richard III., when the minds of those most likely and able to encourage him were seldom free from alarm for their own safety, their time much occupied, and their means necessarily reduced by the distracted and wasted state of the country; and when little attention or money could be spared

for literature; we must give Caxton great credit for having done so much; for having in the midst of confusion persevered in his labours, and succeeded in establishing the art of printing in his native land. That England at this period was much behind France in literature, is proved by the fact that Caxton was obliged to have recourse to the French language for most of the works which he printed. He thus, it may be supposed, employed his press profitably to himself, and certainly with advantage to our literature; for, as Mr. Warton truly observes, "had not the French furnished him those materials, it is not likely that Virgil, Ovid, Cicero, and many other good writers, would, by means of his press, have been circulated in the English tongue, so early as the close of the fifteenth century."

There was, perhaps, at that time, no man in England, whose talents, habits, and character, were so well fitted to introduce and establish the art of printing as those of William Caxton: to have succeeded in this enterprise, the benefits of which, in a national point of view, we may even now be enjoying, is praise enough; for it is the praise of having been a useful citizen of the state and member of society,—the highest that man can bestow or receive.

Caxton's printing is inferior, in many respects, to the printing executed on the continent during the same period. The types employed in the latter have a squareness, fineness, and brilliancy not in those of Caxton; the paper and press-work are much superior; the order and symmetry of the press-work are qualities which appear in very few of his productions. He seems not to have been able to procure, or to have rejected, the roman letter, even after it had been employed with excellent effect by the continental printers. On the other hand, as Mr. Dibdin remarks, "whenever we meet with good copies of his books, his type has a bold and rich effect, which renders their perusal less painful than that of many foreign productions, where the angular sharpness of the letters somewhat dazzles and hurts the eye." His ink is of an inferior quality; his paper is fine and good, resembling the thin vellum on which MSS. were then generally written; his letter is a mixture of secretary and Gothic, also resembling that used in MSS. at that period; his leaves are seldom numbered, his pages never. When the impression was finished, Caxton revised a single copy, and corrected the faults with red ink; the copy thus corrected was then given to a proper person to correct the whole impression; as he was extremely exact, this operation occasioned him much troublesome and minute labour.

## Chapter VI.

*Notices of some other Printers in England, contemporary with Caxton, or immediately after him—Printing introduced into Oxford, Cambridge, St. Alban's, York, Southwark, Tavistock, Ipswich, &c.—into Scotland and Ireland.*

Printing-presses were set up in England by some foreigners and natives, before Caxton's death. In 1480 and 1481, John Lettou, a foreigner, printed in London. He is said to have come over to this country on Caxton's invitation. This, however, is not likely, as his unskilfulness is such that Caxton would scarcely have invited or encouraged such a bad workman. The types he employed in the only two books he is known to have printed himself, are rude and broken. After he had published them, he was taken into the printing-office of William de Machlinia—first, it is supposed as a journeyman, and afterwards as a partner. Machlinia also was a foreigner; the only celebrity that can attach to the name of these partners, arises from their having printed the first edition of 'Littleton's Tenures,' in a small folio, without date. Their printing-office was near All-Hallows church; their letter, a coarse Gothic one. The partnership was of very short continuance; for, in 1483, Machlinia's name alone appears. Wynkyn de Worde was a man of very superior talents and skill. He was a native of Lorraine, and came into England either along with Caxton, or was afterwards invited by him; he was employed as Caxton's assistant till his death. He continued in his office, as his successor, till between the years 1500 and 1502; when he removed his printing-office to the sign of the Sun, in the parish of St. Bride's, where he died in 1534. Soon after he began business for himself, he greatly improved the art by cutting his own punches, which he sunk into matrices, and casting his own letter. His books are remarkable for their neatness and elegance. Four hundred and eight are known to have been printed by him. His edition of the

'Polychronicon' is deemed uncommonly well executed. Dr. Dibdin calls it "one of the most beautiful folio volumes of that skilful artist:" its date is 1495. Several grammarians of repute, Stanbridge, Garlandea, Whittinton, Holt, and Lilye, lived at the period of the introduction of printing into England; and Wynkyn de Worde, who appears to have been a man of good education as well as talents, printed some of their works. He printed the 'Accidence' of Stanbridge, "in Caxton's house, at Westminster." The date unknown. His 'Vocabulary,' in 1500. This De Worde continued to republish till 1532. The 'Multorum Vocabulorum Equivocorum Interpretatio,' by Garlandea, was printed in 1500, by De Worde, and at least as late as 1517. He also printed repeatedly the grammatical works of Whittinton. Holt's 'Lac Puerorum, or Milk for Children,' was printed by him in 4to, without date. No impression of the grammar of Lilye (but which, in reality, was drawn up by several persons,) by De Worde, or in Lilye's lifetime, has been discovered. The first Greek letters used in England are found in a Grammatical Treatise of Whittinton, by De Worde, in 1519: they are cut out of wood. We have gone into this detailed mention of those works chiefly in order to show the assistance which the press was already giving, in its earliest days, to elementary education. 'Accidences,' 'Lucidaries,' 'Orchards of Words,' 'Promptuaries for Little Children,' were published in great numbers.

Richard Pynson, a Norman by birth, was in Caxton's office. He carried on his business from 1493 to 1531. His known productions are two hundred and ten. He styled himself King's Printer; but it is doubtful whether he had any patent. He introduced the Roman letter into this country. His types are clear and good; but his press-work is hardly equal to that of De Worde. Most of the works he printed are of a higher character for merit and usefulness than those either of Caxton or De Worde. The first treatise on arithmetic, published in this country, was printed by Pynson, in 1522, 4to, 'Libri 4 de arte Supputandi.' It was written by Cuthbert Tonstall, Bishop of London, one of the best mathematicians, as well as general scholars, of his age. In 1499, the first edition of the 'Promptorius Puerorum' came from Pynson's press. He was a voluminous printer of early statutes; and in his time began the publication of what are still called 'Year Books.' Soon after Caxton's death he printed an edition of the 'Canterbury Tales,' and in 1526, reprinted them with a collection of some other pieces of Chaucer. William Jaques was contemporary with Pynson, and printed in conjunction with him the acts passed in 1503. He used a new cut English letter, "equalling, if not excelling, in beauty, any produced by modern foundries." In 1530, the first French and English Dictionary ('Eclaircissemens de la Langue Françoise') was published by John Hawkins. No other work from his press is known.

On the death of Pynson, Thomas Berthelet was appointed King's Printer, by a patent, the earliest that has been found. He dwelt at the sign of Lucretia Romana, Fleet-street. Thomas Godfray was a printer at the same time. These printers embarked in the same concern. From their press came (1532), a complete edition of all that had then come to light of the works of Chaucer. It is on fine paper, and the types and press-work are remarkably neat and elegant. This edition was superintended, and published, under the patronage of William Thynne. To one of this family—perhaps to the same person—Caxton had been indebted for the manuscripts, which enabled him to publish his second and much improved edition of the 'Canterbury Tales.'

If the title of the book (already noticed) purporting to be printed at Oxford, in 1468, be erroneous, as there is strong reason to suspect it to be, then the establishment of printing in this city must have been in 1478. The first known printers there, however, were Theodore Rood, a German, and Thomas Hunt, an Englishman; and their first production Herbert assigns to the year 1485. It is not known in what year printing was introduced into Cambridge. It certainly was very shortly after Caxton established his press in Westminster. The types of the earliest known work which issued from Cambridge, very much resemble Caxton's largest. The first printer at Cambridge, whose name is known, was John Sibert, who is supposed to have been born at Lyons. A few Greek words are interspersed in his edition of Linacre's translation of one of Galen's treatises. This is the earliest appearance of Greek *metal* types.

In 1480, a printing-press was established in the Benedictine Monastery at St. Albans, of which William Walling-

ford was at that time prior. Wynkyn de Worde informs us that the printer was "sometime a schoolmaster;" and he probably was a monk. The types of the book, which is a Treatise on Rhetoric, in Latin, are very rude. Printing was introduced into York, in 1509, by Hugh Goes, supposed to have been the son of a printer at Antwerp. His first production was the *Pica* of the Cathedral of that city; he afterwards removed to Beverley, and then to London. Peter de Triers, probably a native of that city, printed, in 1514, the first book in Southwark: it was the 'Moral Distichs of Cato,' with Erasmus's 'Scholia,' in Latin, 1525, Tavistock. Here was an exempt monastery, celebrated for its lectures on the Saxon language, which were discontinued about the period of the Reformation. Several of its abbots were learned men: and the encouragement in literature is evident by the establishment of a printing-press a few years after the introduction of printing into England. The first printed book was John Walton's Translation of Boethius de Consolatione, in 4to; the printer's name was Thomas Rychard, monk of that monastery. A book, called the 'Long Grammar,' was printed at Tavistock, but no copy of it has been found. A printing-office was first established in Canterbury about 1525; but no name or date is in the book supposed to have been the first printed there. Cardinal Wolsey, on his visit to do honour to his native city, established or patronised a printing-office at Ipswich in 1538; the printer was John Oswen, who removed to Worcester in 1548, where he published a folio and quarto edition of the New Testament. The art was introduced into Norwich about 1570, by Anthony Solen, one of the many foreigners from the Low Countries who introduced all sorts of woollen manufactures into that city.

Between the year 1471, when Caxton began to print, and the year 1540, the English press, though conducted by industrious, and some of them learned printers, produced very few classics. 'Boethius de Consolatione,' in Latin and English, three editions of 'Æsop,' 'Terence,' the 'Bucolics' of Virgil twice, and 'Tully's Offices,' were the only classics printed. From Cambridge no classical work appeared; and the University of Oxford produced only the first book of 'Cicero's Epistles,' and that at the expense of Wolsey.

The most ancient specimen of Scotch printing known, is a collection entitled 'The Porteus of Nobleness,' Edinburgh, 1508. A patent had been granted by James IV. to Walter Chapman, a merchant of that city, and Andrew Mollar, a workman, for establishing a press there in 1507. Very few works, however, appear to have issued from this or from any other Scotch press for the next thirty years. In 1554, one of Knox's Theological Treatises was printed at Kalykow, or Kelso. Hamilton's, Archbishop of St. Andrews, Catechism, and Treatise on the 'Seven Sacraments,' 4to, was the first book printed at St. Andrews, 1552. It was nearly a century after this, before Aberdeen, the seat of another University, could boast of a press. Edward Raban, who published a poem on the death of Bishop Forbes, in 1635, styles himself "Master Printer,—the first in Aberdeen." Ireland was the last European country, except Russia, (and this, in the sixteenth century, could scarcely be reckoned European,) that received the art of printing. The earliest book known is the Common Prayer, printed in Dublin, 1551, by Humphrey Powell. The Library of Trinity College, in that city, contains but one book printed there, even so early as 1633. The first book in the Irish character, was a Liturgy, 1566, for the use of the Scotch Highlanders.

The advantages which have been derived from the invention of printing, and from the perseverance and ingenuity of those by whom it was established, among whom we may place William Caxton, are vast and important; but they are too obvious to require, in this place, an elaborate detail. The productions of men of genius and learning; the records of literature and of science; of whatever is either brilliant in imagination or profound in thought; whatever may either adorn or improve the human mind,—thenceforth became imperishable. The light of knowledge cannot again be quenched—it is free, and open, and accessible as the air we breathe. The future history of the world may, indeed, disclose enough both of misery and of vice; but it cannot again present an universal blank, or be disgraced by another age of utter and cheerless ignorance.

(5)

ROEBUCK, John Arthur

# LIFE OF MAHOMET.

*Introduction.*

SECT. I.—In the seventh century of the Christian era a revolution took place in the religion of the Arabian people, which not only changed the manners and institutions of the Arabians themselves, but materially influenced the destinies of the largest portion of the civilised globe. The wandering and insignificant tribes of Arabia were by this religion united into a powerful nation, filled with a spirit of desperate enthusiasm, and sent forth to be the conquerors of the greatest part of Asia, of all the civilised people of Africa, and some of the most powerful kingdoms in Europe. In a few years these enthusiastic warriors spread their new faith from the Ganges to the Danube.

MAHOMET* was the author of these mighty changes. Arising amidst a rude and ignorant people, he assumed the attributes of the Messenger of God; he declared himself to be divinely inspired; to be expressly sent among mankind to overturn the idolatrous worship of his countrymen, and to establish in its place a new and more pure religion, dictated by the Almighty himself, and destined eventually to be the faith of all the nations of the earth. His countrymen believed in these magnificent pretensions; elected him to be their ruler, and quietly submitted their necks to the yoke of the absolute despotism which he instituted. The history of this extraordinary man, with an account of the institutions which he framed, we are about to lay before our readers.

Previous, however, to any history of the Arabian prophet, a short description must be given of the Arabian people at the time of his appearance. To know precisely what alterations he effected, and the good or evil of those alterations, we should learn the state of civilisation, the religion, government, and manners, which he attempted to improve.

Before we can decide whether the changes he introduced were changes for the better, we must erect some certain standard of excellence with which we may compare both the institutions which he originated, and those which he found already established. Upon the results of this comparison alone, can we estimate the character of the Arabian legislator. Our limits, indeed, will not permit us to perform this comparison as minutely as we could wish: we must indicate rather than describe the standard to which we refer; must present merely a sketch of the important particulars of his institutions, and upon this imperfect evidence pronounce the most impartial judgment we are able.

### DESCRIPTION OF ARABIA.

Arabia, the country of Mahomet, has at all times been an object of curiosity to the intelligent observer, both on account of the peculiarities of its soil and climate, and the remarkable character of its inhabitants. Arabia *Proper* is bounded on the north-east by the Persian Gulf; on the south-east by the Indian Ocean. The Red Sea extends along the whole of its south-western coast; and an imaginary line drawn from the head of the Persian Gulf, to that of the Red Sea, completes the limits of the peninsula. The country contained within these limits exceeds above four times the magnitude of Germany or France*. More extended limits, however, are often assigned to the country designated by the term Arabia. Beyond the imaginary line running from Ailah, at the head of the Red Sea, to the head of the Persian Gulf, the territory of Arabia is sometimes made to extend on the west to Palestine, the isthmus of Suez and Syria; on the east to the Euphrates, and on the north to Syria, Deyar Becr, Irak, and Kuhestan †. By

* *Mohammed* is the correct orthography; we have, nevertheless, for obvious reasons, retained the more popular form.

* Gibbon's Decline and Fall, c, 50, p. 76.

† Anc. Univ. Hist., b. 4, c. 21, p. 336. To those desirous of a particular description of the geography of Arabia we cannot do better than recommend M. D'Anville's Map; and the chapter of the Universal

the Greeks and Romans Arabia was usually divided, on account of the differences of the soil, into the Sandy, the Stony, and the Happy. By the Arabians themselves this division has not been adopted. The territory of Arabia *Proper*, bounded as we have described, was separated by them into five distinct provinces, viz. Hejaz, Yaman, Tehama, Naja, and Yamina. In the Happy Arabia, which occupied the greater part of the coast running along the Red Sea, and in the province of Hejaz, are situated the two famous cities of Mecca and Medina. The former was the birthplace of Mahomet; the latter, when he fled from Mecca, was the city of his refuge, the scene of his first victories—the first country over which he ruled with the authority of a king, and his last resting-place on earth. He died and was buried at Medina.

Arabia is situated under the burning sun of the tropics, and covered for the most part with arid sands, and barren, naked mountains. One part is somewhat exempt from this sort of soil. The hills at a small distance from the coast of the Red Sea are less barren, less scorched than the other parts of the country. The springs of water are there more numerous; the water less disgusting, the air more temperate: when compared with the parched and sandy deserts by which it is surrounded, it may appear an earthly paradise. This Happy Arabia, however, has no navigable rivers, few springs the waters of which are drinkable, and no productions save coffee and frankincense to exchange for the commodities of other countries. Having moreover few manufactures, it is poor both in the luxuries and comforts of life*.

INHABITANTS.

The inhabitants of Arabia are usually divided into two classes, viz. the Arabs of the deserts, or dwellers in tents, and the Arabs of the cities.

DESERT TRIBES.

The Arabs of the deserts are roving bands that wander with their herds over the immense sandy regions of which their country is composed: living partly by the flesh and milk of their camels, partly by the plunder of the caravans which traverse their desolate plains. One illustration amongst a thousand that might be offered, is sufficient to mark their savage condition, and wild, predatory manners. As a mortification by which they hope to please the Divinity, at certain seasons of the year religious truces were observed. They thus, by way of penance, obliged themselves to observe the regulations of civilised society. "It was a custom among the ancient Arabs to observe four months in the year as sacred, during which they held it unlawful to wage war, and took off the heads of their spears; ceasing from incursions and other hostilities. During these months, whoever was in fear of his enemy lived in full security; so that, if a man met the murderer of his father, or his brother, he durst not offer him any violence. . . . . Some of them, weary of sitting quiet for three months together, and eager to make their accustomed incursions for plunder, used by way of expedient whenever it suited their inclinations or convenience, to put off the observance of *Al Moharram* to the following month *Safar**."

Among a people thus unsettled, all government was, as might have been expected, exceedingly fluctuating and uncertain. They were not reclaimed from that barbarous state, in which the strong plunder the weak with impunity. Every man pursued his enemy, without recurring for assistance to the magistrate; and inflicted that punishment which his power and vengeance combined enabled and incited him to inflict. The authority of the magistrate was a shadow: the chief of a tribe might indeed sometimes obtain considerable personal influence; it was the man, however, not the office of magistrate, that was respected. Like all rude people, the Arabs were divided into several petty tribes, which were in fact so many separate nations; and the only species of government acknowledged by those inhabiting the deserts, was a nominal obedience paid by the members of the tribe to their elected chief. As among other nations in the same state of civilisation, their leaders governed rather by

History here quoted. Neither our limits nor our design permit us to be more minute.

† Sale's Pre. Disc., p. 3. Gibbon's Decline and Fall, c. 50. Niebuhr, c. 62, p. 86 Pinkerton's Collection. The limits of the Happy Arabia are variously assigned; the difference is a matter of little consequence.

* Sale's Pre. Dis. pp. 196, 198. Prideaux, Vie de Mahomet, p. 95. *Moharram*—that which is sacred and forbidden by the law. The first month of the year was called Moharram, because war was *forbidden* during its continuance. D'Herbelot, Bib. Orient. Safar was the second month.

example than commands *. The chiefs were always the companions and guides of their tribes in arms; and sometimes the umpires of private disputes. The much vaunted independence of the Arab people, however, when closely investigated, appears little worthy of admiration. It consisted in the independence of the heads of families. The head of a family was subjected, or rather yielded obedience, to no one. But he exercised the most despotic sway over his own family. Wives, children, slaves were all completely under his uncontrolled dominion; and this patriarchal government as it is called, while receiving praises as a system of nearly perfect freedom, held nine-tenths of the people in the most abject slavery †.

Law, in such circumstances, could not be said to exist: written or unwritten, it was unknown to these wandering nations; unless we term *law* that sort of wavering opinion concerning honour in engagements, which necessity creates in every society however barbarous. This rude code of honour, as in all savage tribes, was handed down from generation to generation in a species of uncouth poetry, which, while it assisted the memory, delighted also the imagination of these barbarians. "God," said they, "has bestowed four peculiar things on the Arabs; that their turbans should be to them instead of diadems; their tents instead of walls and houses; their swords instead of intrenchments; and their poems instead of written laws ‡." They could hardly have said any thing more descriptive of an uncivilised people.

### ARABS OF THE CITIES.

The inhabitants of the cities were a still more remarkable race, for although they had abandoned the wandering life of their brethren, and taken up their abodes in cities, they were yet often induced to leave their homes, and indulge in the more active and uncontrolled life of the desert. Though living for the most part by merchandise and manufactures, they also participated in the business of robbery in the desert. The life of the merchant was not found incompatible with that of the soldier, or rather robber; and he who to-day was in his counting-house, or work-shop, might, to-morrow, be at the head of his country's troops, or serving in the ranks as a soldier *. The children of the cities were often confided to the tribes of the desert; and thus became early inured to the toilsome and dangerous life of the wandering Arab †.

The inhabitants of Mecca, Medina, and the other cities thinly scattered along the shores of the Red Sea, appear to have been chiefly employed as wandering merchants. The tribes of the deserts brought whatever productions their country afforded, for the most part ostrich feathers, coffee, and frankincense, to the cities on the coast; and received in exchange the commodities which the city merchants had obtained at the fairs of Syria, Palestine, and Egypt. The traffic with these countries was carried on by means of caravans of camels; the merchants, like the travelling merchants or pedlars of the present day, accompanying their goods, and superintending the sale and purchase ‡. By them was carried on the chief part of the trade existing between the Roman provinces, and the countries of the east; and the port of Jidda on the Red Sea was long celebrated as the emporium of Indian commerce §. This constant communication with more polished nations must, in some measure, have improved this portion of the Arabian people. They were, nevertheless, little better than barbarians. Neither on account of their

* Tacitus, Germ. c. 7.

† Niebuhr's Travels, c. 62, p. 84, Pinkerton's Collection.

‡ Sale's Pre. Disc., sec. 1, p. 38. Goguet, Origine des Lois, 1 Epo. p. 28. Mill's British India, b. 2, c. 9, p. 362, quarto ed. For a description of the *wandering* Arabs, see Niebuhr's Travels, c. 98, Pink. Collection, p. 131. There is every reason to suppose that their manners have remained unchanged from the time of Mahomet to the present day.

* "Mirum dictu, ex innumeris populis pars æque in commerciis aut in latrociniis degit," was the expression of Pliny. (Hist. Nat. vi. 32.) This division of their time between robbery and commerce was the same in the days of Mahomet. Gibbon's Dec. and Fall, c. 50. Mod. Univ. Hist., vol. i., b. 1, c. 1, p. 27.

† Mod. Univ. Hist., b. 1, c. 1, p. 23. Gagnier, Vie de Mah., p. 86. "This was the season of the year in which the nurses of a country called *Badian*, that is, *pays champêtre*, came in great numbers to Mecca for the purpose of obtaining children to nurse. . . . . . Helima took him (Mahomet) into her own country, in which the air was temperate, as well on account of the fertility of the soil, as the sweetness of its waters." The *pays champêtre* of Gagnier appears to mean the wild country inhabited by the desert tribes.

‡ These caravans, like those of present times, were assemblages of merchants, who travelled in large numbers, to protect themselves against the attacks of the predatory desert tribes. Hostile tribes constantly endeavoured to capture the caravans of their enemies, much after the manner of European nations, plundering the vessels of industrious individuals, in the hopes of weakening the hostile nation. See Sale's Pre. Disc., sec. 1. p. 32. Prideaux, Vie de Mahomet, p. 10.

§ Prideaux, Vie de Mahomet, p. 11.

government, their laws, their religion, their literature, nor their manners, did they deserve any other title *.

Like the Arabs of the deserts, the inhabitants of the cities were divided into separate tribes; and not only were the different cities unconnected by the bond of a general government, but the citizens of one town were divided into tribes; each one acknowledging a separate chief, and regarding every other tribe with bitter and interminable hatred. The chiefs derived their power as well from their birth as their personal worth, the people electing them out of certain families, yet having perfect liberty to choose that member of the family who was most agreeable to them †. "The Bedouins, or pastoral Arabs, who live in tents, have many schiechs (*i. e.* chiefs), each of whom governs his family with power almost absolute. All the schiechs who belong to the same tribe acknowledge a common chief, who is called Schiech es Schuech, Schiech of Schiechs, or *Schiech el Kbir*, and whose authority is limited by custom. The grand schiech is hereditary in a certain family; but the inferior schiechs upon the death of a grand schiech choose the successor out of his family, without regard to age or lineal succession, or any other consideration, except superiority of abilities‡." The chiefs of the cities were elected much after the same manner.

GOVERNMENT.

The various provinces were split into small, independent states, possessing governments apparently different, though essentially the same §. In some a single prince, in others, the heads of tribes, who were really a band of princes, ruled like the rajahs of Indostan, or the satraps of Persia, with despotic sway over the people within their dominion. To this dominion there was no check but the dread of insurrection: there were no established *forms in the government*, no certain and specified *laws*, by which it could be controlled; neither did the *manners* of the people serve to diminish its mischievousness. Insurrection was the only existing check; and did no doubt in part keep down the atrocities of these rulers; but be it remembered that in every stage of society misery to a lamentable extent may be produced before the people can determine to brave the difficulties and dangers of an insurrection. Still more completely to ensure the subjection of the people, these rulers seized upon the functions and powers of religion. The ruling men were invariably the priests of the people, the propounders of oracles, and the guardians of the temples and idols *. The mysterious terrors of religion were thus added to the real dangers attendant on an opposition to the will of the governors. That will consequently was almost despotic. "After the expulsion of the Jorhamites, the government of Hejaz seems not to have continued for many centuries in the hands of one prince, but to have been divided among the heads of tribes; almost in the same manner as the Arabs of the deserts are governed at this day. At Mecca an aristocracy prevailed, where the chief management of affairs till the time of Mahommed was in the tribe of Koreish; especially after they had gotten the custody of the *Caaba* from the tribe of Kozrah †." But if the government were not better than that of the desert tribes, miserable indeed must have been the situation of the people. When men are congregated into cities, if every one be allowed to gratify his revenge, and punish his enemy, without recurring to the arbitration of the magistrate, the state must necessarily become one continued scene of violence and bloodshed. No security for person or property existing, there could be no accumulation, so that the horrors of poverty must necessarily have been added to the other evils arising from unceasing terror and alarm. Such was in reality the situation of the Arabian cities; every man sought to redress by his own power the injury he fancied he had received; and the peace and happiness of the com-

* See, for a minute description of the laws and customs of the Arabs, Anc. Univ. Hist., vol. xviii., b. 4, c. 21. This description is by Sale.

† A curious plan was adopted in some places. "The order of succession in these cities was not hereditary, but the first child born in any of the noble families, after the king's accession, was deemed the presumptive heir to the crown. As soon, therefore, as any prince ascended the throne, a list was taken of all the pregnant ladies of quality, who were guarded in a proper manner till one of them was delivered of a son, who always received an education suitable to his birth." (Anc. Univ. Hist., vol. xviii., b. 4, c. 21, p. 377.)

‡ Niebuhr's Travels, c. 62, p. 84.

§ Mod. Univ. Hist. b. 1, c. 1, p. 41. Sale's Pre. Disc., s. 1, pp. 12—15. Gagnier, Vie de Mah. vol. i. p. 18.

* Mod. Univ. Hist., b. 1, c. 1, p. 7. Gagnier, Intr. Vie de Mah. pp. 51—53.

† Caaba was a temple at Mecca, held in extraordinary veneration by the people of Arabia universally, (Sale's Pre. Disc., see p. 15,) and to which pilgrimages were made. Mahomet continued the practice. (Gagnier, Intro. Vie de Mah. pp. 56, 57.) Thus, like many other propagators of religion, moulding the forms of the religion which he attacked, to suit that which he preached.

munity were destroyed. The heads of tribes, moreover, waged continual war with each other. In the desert they were sufficiently willing to take offence at each other's conduct: opportunities of offence, however, on account of the immense extent of these desert regions, were far less frequent than within the narrow bounds of a city. Contact created rivalry—rivalry in power, in display, in enjoyment: rivalry begat hatred; and hatred bloodshed. To gratify the morbid vanity of a chief, the whole tribe was in arms. "This multiplicity of petty sovereigns occasions several inconveniences to the people in general. Wars cannot but be frequent among states whose territories are so intermingled together, and whose sovereigns have such a variety of jarring interests to manage. . . . . . . . No doubt such a multitude of nobles and petty princes, whose numbers are continually increased by polygamy, must have an unfavourable influence upon the general happiness of the people. It strikes one with surprise to see the Arabs, in a country so rich and fertile, uncomfortably lodged, indifferently fed, ill clothed, and destitute of almost all the conveniences of life. But the causes fully account for the effects. . . . . . . . . Those living in cities, or employed in the cultivation of the land, are kept in poverty by the exorbitancy of the taxes exacted from them. The whole substance of the people is consumed in the support of their numerous princes and priests *."

### LAW.

Added to this rude government was an equally imperfect *law*. The law, in fact, seems to have been in the rudest possible state; there being neither a written code, nor any collection of judicial decisions which successive judges were enjoined to follow. Judicial decisions were consequently in complete accordance with the desires of the rich. In a country where there is an established code to which every judge must adhere, justice for the most part is impartially administered. Some plausible reason must be assigned for every deviation; the approval of the government, the men of the law, and even of the people, must, in some measure, be obtained; and by this means a check is created, sufficient, in general, to protect the community from the grossest excesses of injustice. Under a despotic government, indeed, the law is obliged to yield to the will of the prince. When he wishes oppression, oppression is exercised. These cases must of necessity form but a small part of the whole number which come before the judge for decision; and when the will of the prince is not opposed to justice, the judge finds himself obliged to adhere to the letter of the law, that being, in fact, the will of the prince. Imperial Rome, France, and Germany, in which justice has been administered under a despotic monarch, according to a written code, are evidence of the truth of these observations. Where law had not been digested into a code, but is composed of recorded decisions, the consequence is nearly the same. "When on any particular portion of the field of law," says the philosophic historian of British India, "a number of judges have all, with public approbation, decided in one way, and when those decisions are recorded and made known, the judge who comes after them has strong motives of fear and hope, not to depart from their example *." But of law, either of one kind or the other, the Arabians were utterly destitute. The judge, that is the head of the tribe, decided according to what he deemed to be justice; and his unrecorded decision had no influence upon that of his successor. Uncertainty to the greatest possible extent was the necessary consequence. Those who sought a decision at the hands of the judge, found him unchecked by any existing law, and ready to listen with complacency to the suggestions of interest. He, therefore, who was the most powerful, or the most wealthy, had a certainty of success. Any change from such a state must have been a change for the better.

### RELIGION.

Although the Romans made no extensive or permanent conquests in Arabia, the effects of their near neighbourhood were visible among the Arabian population. The constant disputes between the Christian sects of Syria, and the depressed situation of the Jewish people among the Christians, induced many of both persuasions to seek refuge among the idolatrous Arabs, who knew not, or knowing, regarded not, the dif-

* Niebuhr, c. 62, p. 86.

* Mill's Hist. of Brit. India, b. 2. c. 4, p. 170.

ferences in their creeds. Enjoying peace and security, these differing sects continued to increase in numbers, in wealth, and in power; and before the appearance of Mahomet spread their religion over the greatest part of Arabia. The tolerant spirit of the Arabian religion allowed them unmolested to erect places of worship, and to educate their children each according to his faith. This perfect freedom multiplied the Christian sects, and Arabia was long famous as being the prolific mother of heresies *.

The larger portion of the population, however, still adhered to their own national worship; which partook largely of the rude character that marked their other institutions. The conception which an ignorant and trembling savage forms of the character of the Divinity, and the means by which he endeavours to secure his favour, are in every age and country the same. He conceives the Godhead as irritable and revengeful; endowed with the moral weaknesses of humanity, but possessed of irresistible power. Heaven, in the imagination of the barbarian, is a picture of the earth, with this addition, that every circumstance is magnified. In heaven there are more delightful gardens, more delicious and balmy airs, more brilliant skies, than on earth. The beings who inhabit the heavens are more powerful, more wise, or rather, more capable of obtaining the objects they desire, than men; they are endowed with everlasting life, and subject to no diseases that afflict humanity. To please these divine beings, the trembling votary pursues the means that are found efficacious with earthly potentates. He prostrates himself before them in adoration; he exaggerates their perfections, and soothes them with continued adulation. To prove himself sincere, he subjects himself to useless privations; performs frequent, painful, fruitless, and expensive ceremonies. He subjects himself to fasts; he multiplies the observances of religion, and throws away his substance in manifestation of their honour. Solicitude in the regulation of his conduct, as it regards his own happiness, or that of his fellows, being intimately connected with his own interests, is considered no proof of the sincerity of his professions towards the Divinity. The laws of morals, therefore, form but a small part of the religious code of any barbarous nation. The religion of the barbarous Arabian differed in no one particular from the foregoing description.

The ancient Arabs are supposed to have been what are termed pure theists: that is, they are supposed to have believed in, and worshipped, one, sole, omnipotent, and everlasting God. Historians, however, have seldom correctly appreciated the meaning of these magnificent expressions in the mouth of a savage. In his mind such language is connected with ideas and feelings far other than those which a civilised man would express by it. These splendid epithets are the mere expressions of flattery and fear. The deity, now addressed, and whose favour is the object of present desire, is for the time the sole object of adoration. The very same savage, who believes in a host of gods, will address each of them by the term of THE ONE. If among many deities one is thought more powerful than the rest, he will be the oftenest addressed, the oftenest soothed by flattery. No epithet is so flattering as that which asserts his single existence. It exalts him above all beings, and leaves him without a rival. No epithet, therefore, will be so frequently employed. Being the most constantly adored, this more powerful divinity will have this epithet expressive of his sole existence so frequently connected with his name, that it will at length be regularly attached to, and form part of, that name. This was precisely the case with the Arabian objects of worship. It is strange that when complete evidence of this fact exists, really intelligent and circumspect historians should have believed in the pure theism of the Arabians. Sale, like many others, was deceived by pompous expressions:—"That they acknowledge one supreme God, appears (to omit other proof) from their usual form of addressing themselves to him, which was this: 'I dedicate myself to thy service, O God!—I dedicate myself to thy service, O God! Thou hast no companion, except thy companion of whom Thou art absolute master, and of whatever is his.'" In the very next passage, however, Sale adds, "they offered sacrifices and other

* Anc. Univ. Hist., b. 4, c. 21, pp. 378—392. Koran, Sale's trans., c. 53. Sale's Pre. Disc., s. 2, pp. 45, 46. Gibbon's Dec. and Fall, c. 50, p. 99. Pocock's notes to his translation of Abulpharagius, p. 136. Niebuhr states that in his time the Jews were in many parts of Arabia independent nations, and exceedingly numerous, (c. 69, pp. 92, 93.)

offerings to IDOLS, as well as to God, who was also often put off with the least portion, as Mahomet upbraids them*." Their scheme of divine government was simple, and like most others formed in the same state of civilisation. One god was supposed to be the supreme ruler; and subject to his sway was a vast multitude of inferior deities†. "The Arabs acknowledged one supreme God, the creator and lord of the universe, whom they called Allah Taala, the most high god; and their other deities, who were subordinate to him, they called simply Al Ilahat, *i. e.* goddesses‡." Idols were set up, and worshipped; every field, every rivulet, had its divinities. The fixed stars and planets were also exalted into gods, and as such received adoration. Heaven, moreover, was peopled with angels, who, with the wooden stone, and clay idols on earth, were regularly worshipped. How the Arabians can be supposed believers in a single godhead, under such circumstances, appears extraordinary §.

The manner in which these various divinities were rendered propitious, at once marks that no very exalted conception of a divinity existed in the minds of these barbarians. Fasts, pilgrimages, sacrifices, long and unmeaning prayers, were the means employed to obtain the divine favour.

"They are obliged to pray three times a day (some say seven times a day:) the first, half an hour or less before sunrise, ordering it so, that they may, just as the sun rises, finish eight adorations, each containing three prostrations: the second prayer they end at noon, when the sun begins to decline, in saying which they perform five such adorations as the former; and the same they do the third time, ending just as the sun sets. They fast three times a year: the first thirty days, the next nine days, and the last seven. They offer many sacrifices, but eat no part thereof, but burn them all. They abstain from beans, garlic, and some other pulse and vegetables*."

"The same rites which are now accomplished by the faithful Mussulman, were invented and practised by the superstition of the idolaters. At an awful distance they cast away their garments; seven times, with hasty steps, they encircled the Caaba, and kissed the black stone; seven times they visited and adored the adjacent mountains; seven times they threw stones into the valley of Mina, and the pilgrimage was achieved as at the present hour, by a sacrifice of sheep and camels, and the burial of their hair and nails in the consecrated ground . . . . . . From Japan to Peru the use of sacrifice has universally prevailed; and the votary has expressed his gratitude or fear, by destroying or consuming, in honour of the gods, the dearest and most precious of their gifts. The life of a man is the most precious oblation to deprecate public calamity; the altars of Phœnicia and Egypt, of Rome and Carthage, have been polluted with human gore; the cruel practice was long preserved among the Arabs. In the third century a boy was annually sacrificed by the tribe of the Dumatrians; and a royal captive was piously slaughtered by the prince of the Saracens, the ally and soldier of the emperor Justinian. A parent who drags his son to the altar exhibits the most sublime and painful effort of fanaticism; the deed or the intention was sanctified by the example of saints and heroes; and the father of Mahomet himself was devoted by a rash vow, and hardly ransomed by the equivalent of an hundred camels."† Such was the religion that Mahomet endeavoured to improve.

### SCIENCE AND LITERATURE.

It may easily be supposed that a people, possessed of a government, law, and religion, such as we have described, were little advanced in science or literature. The only science to which the ancient Arabs made the slightest pretension, was that of astronomy; and

* Sale, Pre. Disc., p. 21.
† "Divûm pater atque hominum rex,"
O pater, O hominum Divûmque æterna potestas," are expressions conveying an exact conception of the Arabian theology.
‡ Sale, Pre. Disc., p. 20.
§ "The Sabians of Mount Lebanon seem to pay a greater regard to Seth than the Supreme Being; for they always keep their oath when they swear by the former, but frequently break it when they swear by the latter."—(Anc. Univ. Hist., b. iv., c. 21, p. 383.) "A merchant of Mecca made an observation upon those saints, which I was surprised to hear from a Mahometan. The vulgar, said he, must always have a visible object to fear and honour. Thus, at Mecca, oaths, instead of being addressed to God, are pronounced in the name of Mahomet. At Mokha, I would not trust a man who should take God to witness the truth of any thing he happened to assert; but I much more safely depend upon him who should swear by Schiech Ichadeli, whose mosque and tomb are before his eyes."—(Niebuhr, p. 76.) Pocock, in his notes to his translation of "Abulpharagius" (p. 136,) states the worship of angels and demons to have been common among the Arabs.

* Sale, Pre. Disc., p. 19.
† Gibbon, Decl. and Fall, c. 50, pp. 95, 96.

even in astronomy they had discovered little beyond the ordinary knowledge of an ignorant savage. Through the trackless deserts of Arabia it was impossible to travel without the aid of some sign in the heavens as a guide. The need of such a guide led them to watch the revolutions of the heavenly bodies; and the clear and unclouded skies of the country offered few obstacles to their search. They could not in time fail to observe some of the more obvious phenomena, and to be able in a long course of years to predict the recurrence of those phenomena. Some few extraordinary persons seem to have been capable of calculating eclipses with tolerable accuracy. This knowledge, however, was exceedingly rare, and beyond it they never advanced. Any thing like a theory, or general expression of the stated order in which the celestial phenomena occurred, never entered into their imaginations. That certain changes happened, they knew; but of the true system of the universe, or of any system whatever, they were profoundly ignorant*. Astrology, indeed, they studied with some assiduity, and implicit confidence; but the most important of their sciences, that to which they paid the greatest attention, was the interpretation of dreams†. The following is a specimen of their state of ignorance and superstition: "When any of them set out upon a journey, he observed the first bird he met with, and if it flew to the right, he pursued his journey; but if to the left, he returned home . . . . . . When a person, distrusting the fidelity of his wife, went a journey, he tied together some of the boughs of a tree, called *al rataim;* and if, on his return, he found them in the same position, he judged she had been faithful to him; if otherwise, not ‡."

Their eloquence and their poetry have been considered evidence of a high state of civilisation. But the savages of North America have been long famed for their eloquence; and the bards of our barbarian ancestors prove that savages have possessed, and been delighted with poetry. The eloquence and poetry of a barbarian, bear, however, little resemblance to the eloquence and poetry of civilised life, being made up chiefly of bold figures and bombast expressions, without order, without propriety, and generally without meaning. The *species* of estimation, also, in which poetry was held among the Arabs, shows their rude and uncultivated condition. It was held in esteem as a means of preserving the remembrance of past events. Poetry assists the memory; and consequently the history, laws, and dogmas of religion, are universally among a rude people recorded in verse*. In the absence of written signs, verse may be of use in this way, but, when writing is known, can, for such a purpose, be no longer serviceable. That the Arabs generally were ignorant of writing is universally asserted. In after times, the Arabians, like other people, emerged from this state of ignorance. The age of Arab learning and literature, however, was more than two centuries after the death of Mahomet. When masters of Syria and Egypt, they became acquainted with the writings of the Greek philosophers, and for a long period were far superior to the nations of Europe in knowledge and civilisation.

### MANNERS.

In spite of their ignorance, the Arabs have by historians been almost universally deemed a gentle and polite people; and an argument has, from this circumstance, been hastily drawn against the utility of all knowledge and cultivation. Nothing, however, can well be more untrue than the premises upon which this conclusion is founded.

Two circumstances have chiefly been insisted on, in favour of the Arab people: their hospitality and their politeness. The meaning of these terms, however, when applied to them, is sometimes misunderstood. The general conduct of the Arab was to plunder and to kill every defenceless traveller whom he chanced to meet †. There were particular cases in which he abstained from this barbarity; when, instead of robbing, he assisted the way-faring traveller. This extraordinary abstinence has been exalted into the virtue *hospitality*. He was thus generous to those of his own tribe, and to those who possessed a

* See Goguet, Orig. des Lois, 1 Epo. l. 3, p. 147, where the necessity, under which the Arabians lay, of some sign to guide them in their travels, is well explained. Also Abulpharagius, Pocock's translation, p. 6. The Arabian fairly acknowledges his countrymen to have been completely ignorant of the *science* of astronomy.

† Anc. Univ. Hist., b. iv., c. 21, p. 406—412.

‡ Ibid. p. 412.

* See Goguet, Orig. des Lois, 1 Epoc., l. 1 pp. 43, 44. Henry (in Hist. of Britain, b. 1, c. 2 sec. 1, p. 163, states,) that the Ancient Britons were a very poetical people.

† Sale, Pre. Dis. pp. 196—198. Prideaux, Vie de Mah., p. 95.

passport from his chief; to others, he was a thief and a murderer. In a civilised country abstinence from plundering any one, whether kindred or not, is not exalted into a virtue; and for this simple reason: it is imposed by the law as an *obligation* upon every one; every infringement of it is punished; and so common is this boasted virtue, that the *absence* of it alone creates our wonder.

The traveller in the desert, or in any wild country, would perish if the few inhabitants that are scattered over its surface were to refuse him aid and shelter. But to save the life of a fellow creature, without risk or trouble to ourselves, is surely no great exercise of virtue; and so obvious is the necessity of such mutual assistance in a rude state of society, that no people placed in such circumstances ever failed to hold in high estimation, and also in some measure to practise, this species of hospitality.

When a country becomes thickly inhabited, the necessity for hospitality no longer exists, it consequently ceases to be praised or regarded. The traveller to whom I should refuse admittance, can find immediate refuge at the next inn; and consequently will not subject himself to the mortification of a refusal. The following exceedingly sensible observations cannot but be acceptable to the reader: " I forgot to speak of hospitality. It is on account of this virtue that the first ages have usually been esteemed . . . . . . A common interest apparently gave birth to this habit. There were no inns in the distant ages of antiquity. Hospitality was, therefore, exercised in hopes of a return of the like good office. A stranger was received, under the supposition that he might some day render the same service, should there be a necessity of travelling into his country; for hospitality was reciprocal. By receiving a stranger into his house, a man immediately acquired a right to be received into the stranger's; and this right was by the ancients regarded as sacred and inviolable, extending not only to those who contracted it, but also to their children and descendants. Besides, hospitality in those early days was not very expensive, as people travelled with few attendants. In short, the Arabs of the present day prove that hospitality is compatible with the greatest vices; and that this species of virtue is no evidence of goodness of heart or rectitude of manners. The general character of the Arabs is well known; no people, however, are more hospitable*."

The politeness of an Arab is also something very different from the politeness of a civilised man. True politeness or courtesy consists in taking no offence where offence is not intended, and in so managing the common intercourse of life, that the forms adopted shall conduce to the ease and happiness of all parties concerned. All formalities that do not tend to this end, all distinctions that oppose it, are so many marks of rudeness and ignorance. How far the Arabs were from this standard, the following circumstance will testify:—

" The Arabs show great sensibility to every thing that can be construed into an injury. If one man should happen to spit beside another, the latter will not fail to avenge himself of the imaginary insult. In a caravan I once saw an Arab highly offended with a man who, in spitting, accidentally bespattered his beard with some small part of his spittle. It was with difficulty that he could be appeased by him, who, he imagined, had offended him, even though he humbly asked pardon, and kissed his beard in token of submission. . . . . . But the most irritable of all men are the noble Bedouins, who, in their martial spirit, seem to carry those same prejudices even farther than the barbarous warriors who issued from the north, and overran Europe. Bedouin honour is still more delicate than ours, and requires even a greater number of victims to be sacrificed to it. If one schiech says to another, with a serious air, thy bonnet is dirty, or the wrong side of thy turban is out, nothing but blood can wash away the reproach; and not merely the blood of the offender, but also that of all the males of his family†." Who, when cursed with so punctilious and bloody minded a neighbour as this, would not be careful in his conversation and conduct?

" The refined malice of the Arabs refuses even the head of the murderer, substitutes an innocent to the guilty person, and transfers the penalty to the best and most considerable of the race by whom they have been injured. If he falls by their hands, they are exposed in their turn to the danger of reprisals; the interest and the principal of the bloody debt are accumulated; the individuals of either family lead a life of

* Goguet, Orig. des Lois, 1 Epo., l. 6, p. 387.

† Niebuhr, c. 107, p. 144.

malice and suspicion, and fifty years may sometimes elapse before the account be finally settled*."

The condition of the women may be taken as an accurate criterion of the politeness of a people. If we judge of the Arabs by this test, they will be considered barbarians. Even in the Koran, which certainly is an improvement on the previous manners of the Arabs, we find the following command :—

"But those wives, whose perverseness ye shall be apprehensive of, rebuke, and *remove into separate apartments, and chastise them*†."

"It must be remembered," says Sale, "that though by the Mahommedan law, a man is allowed to repudiate his wife, even on the slightest disgust, yet the women are not allowed to separate themselves from their husbands, unless it be for ill usage, (we have seen that beating them was not considered ill usage,) want of proper maintenance, neglect of conjugal duty, or some other cause of equal import; *but then she loses her dowry* (that is, when ill-treated, and seeking redress at the hands of justice, redress is given, but the means of subsistence are taken away,) which she does not, if divorced by the husband, unless she has been guilty of impudicity or notorious disobedience‡," of which men were the judges. In another passage, he says, "they disposed of widows even against their consent, as part of their husbands' possessions§."

In short, the women were absolute slaves; the mere instruments of their husbands' pleasure; confined, neglected, and despised. Professor Millar, in his work on the "Origin of Ranks," has acutely remarked, that the custom so prevalent in ancient times of the bridegroom giving presents to the father of the bride, was, in reality, nothing less than a custom of *buying* the daughter. That the Arabians followed this custom, is admitted by the Arabian authors themselves. Ali, on his marriage with Fatima, the daughter of Mahomet, gave to him, according to tradition, twelve ounces of ostrich feathers, and a breastplate*. That this was, in fact, a purchase, is shown by the manners of the Arabians of the present day, who preserve the custom, and do not attempt to conceal the nature of it†. It is almost needless to say, that slavery of the very worst description must necessarily be the heritage of the women, where such a custom exists. Taught to consider themselves the property of their purchasers, they must, moreover, become degraded in their mental and moral character; and their masters, also, cannot but feel the baneful influence of this abominable traffic. Any institution which permits men to exercise irresponsible power; which, above all, makes the exercise of it, daily, nay, hourly, and the scene of its employment, the bosom of their families, would, of itself, be sufficient to degrade a whole people. Politeness, or gentleness of mind or manners, on the part of the men, are utterly inconsistent with such barbarous treatment of the women. We may, therefore, without fear of error, conclude that the Arabs deserve not, on this head, the praise which has been somewhat lavishly bestowed on them.

Having now, as far as our limits will permit, given a general view of the situation of the Arab people at the time of Mahomet's appearance, we shall proceed to relate the history of the Prophet himself. With this view before us, we shall be able more easily to understand the several circumstances of his life; more correctly to judge of his abilities and his character. Knowing the people, among whom he arose—their state of civilisation, their manners, and their laws, we can, without much difficulty, discover whether he were superior to his age, and whether he advanced or retarded the improvement of his countrymen.

SECT. II.—A description of the sources from whence our knowledge concerning Mahomet is derived is, however, another necessary preliminary to the history of his life: an historian can hardly render a more important service

* Gibbon, Decl. and Fall, c. 50, p. 89. See also Niebuhr, c. 107, p. 144, for a story of Arab vengeance and brutality.

† Koran, c. 4, p. 101.

‡ Prel. Disc., p. 178. Husbands seem to have felt little compunction at repudiating their wives, with or without a pretext. Hassan, the son of Mahomet, considered a good man by his countrymen, "though his wives were all of them remarkably fond of him, was yet apt very frequently to divorce them, and marry new ones."—(Ockley's Hist. of the Saracens, vol. ii., p. 105, ed. 1718.) Nothing could mark a more complete recklessness concerning the happiness of women.

§ Sale, Prel. Dis., p. 183.

* Ockley's Hist. of Sarac., p. 21. He adds, in a note, "It seems to have been a custom among the Arabs for a bridegroom to make a present to the father of the bride." Among the ancient Germans, also, the custom was prevalent.—(Tac. Germ.)

† See "Mahometism Explained." Translated by Morgan, vol. ii., p. 30.

to his readers than clearly to point out the evidence upon which his statements are founded.

The writers from whom the world has derived all its present information concerning the life and institutions of Mahomet may be divided into three classes, viz., the Arabian writers themselves; the contemporary Christian writers; and the more profound, liberal, and enlightened scholars of modern days.

1. Some years after the death of Mahomet, his works, supposed to be revelations from the Almighty, were collected and put into their present order by the then reigning Caliph. As the prophet could not write, he employed scribes, who wrote, at his dictation, those revelations of the Divine will, at many different and distant periods of his life. The palm-leaves, skins, and bones, upon which they were transcribed, were thrown without order into a trunk, which, with its contents, was placed in the custody of one of the prophet's numerous wives. Abubeker, who succeeded Mahomet as Caliph, is supposed to have had these important documents copied; and corrected according to the recollection of such of the prophet's followers as had committed to memory his revelations at the different times at which they were delivered. These several documents being then arranged in their present order, the whole collection was denominated the KORAN.

The discourses or revelations of the prophet having almost always been occasioned by the necessities of the moment, constant allusions are made in them to circumstances then occurring; they thus become historical evidence *.

In addition to these sacred writings of Mahomet himself, a book of TRADITIONS, called the SONNA, was collected, containing those actions and sayings of the prophet not recorded in the Koran. These traditions were gathered from his wives and companions, and are by one great sect of the Mussulmans, viz. the Sonnites, believed to be authentic and of authority equal to the Koran itself †.

These two books, in so far as they are narrations, may be considered the narrations of *percipient* witnesses; of persons who saw and heard the circumstances and discourses they relate. And these are the only records that pretend to be the evidence of persons actually witnessing the circumstances narrated. The worth of these records as historical documents is dependent on the trustworthiness of those who related, and of those who collected, corrected, and attested them. If these narrators and collectors be unworthy of belief, the Koran and the Sonna are nearly worthless.

Two circumstances powerfully concur to depreciate the trustworthiness of these persons, viz. their interest and their ignorance. That they were deeply interested in their prophet's fame is too obvious to be insisted on. The renown of their prophet reflected on themselves; as that was increased so were they exalted. On the other hand, to be the followers of a fool or knave, was to prove themselves fools or knaves. But their own experience in the case of their prophet himself had taught them that to gloss over folly and knavery, no method was so efficacious as declaring it to be sanctioned by the divinity. The other equally powerful cause of untrustworthiness is their ignorance. Their ignorance and credulity are sufficiently manifested by the stories they have related and believed, and by the consequences they have derived from them. That Mahomet imposed upon many of them is certain, otherwise he could never have succeeded in establishing his pretended religion. But to believe him on the evidence he adduced to be the apostle of God; to put faith in the absurd stories he related; to acquiesce without investigation in the doctrines he promulgated, shows them to have been credulous, ignorant, and careless concerning the opinions they embraced. In any case this carelessness would materially have diminished the worth of their testimony, but utterly destroys it when, as in the present instance, a great degree of firmness was requisite to resist the prevailing torrent, as well as of acuteness and ability to gather evidence by which to detect and expose the imposture. But if so easily deceived, and so deeply interested, in what cases are they worthy of belief? In those where they have no manifest advantage in lying; where the matter to be judged was not above the comprehension of an ignorant barbarian; and where the falsity of the testimony, even of ignorant

* Sale, Pre. Dis. sec. 3. pp. 85, 86. Prideaux, Vie de Mah., pp. 47—61. Mod. Univ. Hist. b. 1. c. 2. p. 308.

† Mod. Univ. Hist. b. 1. c. 1. pp. 80, 82, 87. See also Sale, Pre. Dis. Sec. 8. pass.—"The different sects of the Mohammedans may be distinguished into two sorts: those *generally* esteemed orthodox, and those which are esteemed heretical. The former, by a general name, are called Sonnites or Traditionists."

and interested witnesses, appears more wonderful than the circumstance they relate*.

Whatever the Arabian writers of after days have related, they have related on the authority of these traditions. These later historians cannot therefore be adduced as *additional* evidence. They repeat merely what they have heard; and having listened with minds little capable of distinguishing truth from falsehood, they have given implicit faith to every monstrous and improbable story favourable to their false prophet. Bred to be believers in his imposture, they were unfit for the task of examination.

2. The next class of historians are the Christian writers, contemporaries of Mahomet; and they are even less trustworthy than the Arabians themselves. They were equally ignorant, equally bigoted, equally interested, but they were not *percipient* witnesses. This combination of circumstances renders their testimony as untrustworthy as human testimony well can be. Of the Christians who were contemporaries of Mahomet, the Greeks of Constantinople were alone removed one degree from utter barbarism. On these men, such as they were, we must partly depend in describing the original institutions of the Arabian prophet. What merit ought to be ascribed to them may be easily learned. Witchcraft they devoutly believed in; and moreover gravely maintained the miracles of Mahomet to have been actually performed, but performed through the instrumentality of the devil. One thing, and one thing alone can be said in favour of these Greek authorities. Mahomet, during his life, had numerous enemies among his countrymen, who were impelled by their interest and their hatred to collect and spread whatever reports were to his prejudice. Many, doubtless, were invented, some, probably, were true. Whatever they were, the Greeks seized upon them with avidity, and triumphantly recorded the abominations of the impostor. By this means, evidence has been preserved (doubtful evidence indeed) against the prophet which the success of his religion has in his own country completely obliterated. Moreover, whatever these men admit in favour of Mahomet may be pretty confidently relied on: for the good they could decently have denied, would never have been acknowledged.

3. Of the writers of modern days the character is somewhat different. Although feelings of hostility to our Mohammedan brethren still exist, yet the present knowledge of Europe renders it impossible for the same mendacity to pervade the writings of modern as of ancient historians. We have now almost universally ceased to regard our own faith as at all concerned in the estimation that may be formed of the character, opinion, conduct, or religion of Mahomet. As our interests have become less concerned, our judgments have become more impartial. We have learned moreover that the employment of calumny and falsehood in support of any system, however admirable, is neither just nor prudent. This knowledge has been but lately acquired. Prideaux himself, among the most violent and unfavourable of Mahomet's modern historians, admits, "that zealous Christians have foolishly invented fables, for the purpose of bringing the impostor into contempt*." In addition to these circumstances in favour of modern writers, is the high degree of excellence to which the knowledge of eastern literature, history, and institutions has now arrived. Our enlightened travellers have explored the vast regions of Asia, from one end to the other; have minutely described the customs of the people, and collected a mass of evidence respecting their various institutions far superior to that which our predecessors possessed. We may now speak with comparative certainty regarding the religious and political institutions of Mahomet. But of Mahomet himself, we must for ever rest contented with a broken and uncertain history. In spite of the researches of modern industry, every thing respecting him must remain involved in considerable obscurity. What is believed, is believed on extremely doubtful evidence. The facts related of him assume no connected form, but evidently appear the transactions of many years distant from one another. They are broken, isolated fragments of history, which cannot correctly be formed into a consecutive narrative. The histories of Mahomet hitherto written do not indeed appear thus disjointed. Historians are apt to confound

* Gagnier acknowledges the traditions of the Koran and the Sonna to be for the most part *Romances!* (Pre. p. 39.) See Mod. Univ. Hist. b. 1. c. 1. p. 80; where an account is given of the *genealogy* of these traditions.

* Vie de Mah., p. 57.

matters of inference with matters of fact, what they relate upon testimony, with what they infer as a consequence from that testimony; and where facts are wanting, to insert their own opinions as connecting links to the separate events really recorded. It will be our constant endeavour to keep them apart; to present to the reader's mind the circumstances which tradition has handed down, without mixing them up or confounding them with the conclusions which we and others have drawn from those circumstances. Knowing what depends upon evidence, what on our judgment, the reader will be able to give each its due weight and importance.

SECT. III.—Mahomet was born some time during the sixth century, at the city of Mecca. The precise year of his birth is disputed, and after much learned discussion the matter is left nearly as doubtful as when the dispute began. The most probable opinion, however, seems to be that of Elmacin, an Arabian writer, who, according to Hottinger, has placed his birth A. D. 571; but, according to Reiske, A. D. 572. The precise era of his birth being an unimportant circumstance, we shall dismiss it without further comment*.

The lineage of the prophet has also been a subject of furious altercation. Interest and blind prejudice both concurred to create and continue the controversy. On the one hand he was degraded to the lowest rank of society, while, on the other, he was exalted above most of his countrymen. The contemporary Christian writers hated the prophet, and wished to render him an object of contempt. To their ignorant and prejudiced minds, to describe him as having sprung from a plebeian race, appeared the most effectual means of rendering him despicable. In the same degree that the Christians believed themselves interested in degrading the Arabian prophet, did the Mahometans feel themselves called upon to exalt him; and their ignorance, equal to that of their adversaries, deemed his pedigree an important consideration. What their interest and vanity counselled, they were not scrupulous in pursuing. An alliance with the great is often deemed an honourable distinction. Next to being great one's self, is to have great connexions. Inasmuch, therefore, as the votaries of Mahomet were deeply interested in enhancing his worth, it is not surprising that they should confer upon him a line of ancestry connected with the most ancient and interesting periods of their history. Ismael was usually supposed to be the founder of their race, and they were accustomed to regard him with reverence almost amounting to devotion. The tribe of Koreish, to which Mahomet belonged, had before the birth of the prophet laid claim to Ismael as their progenitor. This claim arising from the vanity of the tribe was eagerly laid hold of by his pious adherents; and what was before mentioned and maintained through a pardonable ostentation, became a dogma of religion, and was defended with all the fury which bigotry engenders.

Without the assistance of fable, Mahomet was able to vindicate to himself a high lineage among his countrymen. Abdallah, the father of Mahomet, was a younger* son of Abdol Motalleb, the son of Hashem. "Hashem," say the authors of the *Modern Universal History*, "succeeded his father Abdal Menaf, in the principality of the Koreish, and consequently in the government of Mecca, and the custody of the Caaba†." So far the genealogy of the prophet is supported by authentic history—that he was descended from the princes of his people cannot be denied. This descent from Ismael, Gibbon, after Sale, thus disproves: "Abulfeda and Gagnier describe the popular and approved genealogy of the prophet. At Mecca I would not dispute its authenticity; at Lausanne, I will venture to observe—1st. That, from Ismael to Mahomet, a period of two thousand five hundred years, they reckon thirty instead of seventy-five generations. 2d. That the modern Bedoweens are ignorant of their history, and careless of their pedigree‡."

Abdallah, though of high lineage, was

* Those who are curious in such matters, may consult Bayle, art. Mahomet, note B.; and Gibbon, Decl. and Fall, c. 50, where the original authorities are mentioned. Gibbon shrewdly remarks—"While we refine our chronology, it is possible that the illiterate prophet was ignorant of his own age." Niebuhr, in speaking of an Arabian whom he met, says, "He told us that he was above seventy years of age; but his acquaintance affirmed that he was not under ninety. We had observed of the Mussulmans in general however, that they seldom knew their own age exactly. They reckon by the most remarkable incidents in their lives, and say, I was a child when such an event happened, or when such a one was governor of a city." (p. 32.) Gagnier says, that Mahomet was born A. D. 578. A. V. 569., vol. i., p. 71.

* Prideaux, Vie de Mah., p. 8, says, he was the eldest. This assertion Sale proves to be erroneous.
† Vol. i., p. 10, Mod. Univ. Hist.
‡ Decl. and Fall, c. 50.

possessed of little wealth; and as he died while his son was yet an infant*, we may easily suppose that little to have been diminished by the rapacity of his kindred. The uncles of Mahomet were numerous and powerful, and as in an age little removed from barbarism the rights of the weak are seldom respected, he was plundered with impunity. "The pagan Arabs used to treat widows and orphans with great injustice, frequently denying them any share in the inheritance of their fathers or their husbands, on pretence that the same ought to be distributed among those only who were able to bear arms; and disposing of the widows, even against their consent, as part of their husbands' possessions†." A proof that the orphan Mahomet was no better treated than his neighbours is, that he received out of his father's patrimony no more than five camels, and one Æthiopian slave.

How poor soever Mahomet may have been in worldly goods, his birth was rich in prodigies. We are told with unfeigned belief by his deluded followers that at the moment the favoured infant issued from his mother's womb, a flood of brilliant light also burst forth, and illuminated every part of Syria; the waters of the Lake Sawa disappeared; an earthquake threw down fourteen towers of the King of Persia's palace; the sacred fire of the Persians was extinguished, and all the evil spirits which had formerly inhabited the moon and stars were expelled simultaneously from their celestial abodes. The child itself manifested extraordinary symptoms. He was no sooner born, than he fell upon his face and prayed devoutly,—saying "God is great: *There is only one God, and I am his prophet.*" These stories, extravagant as they appear, were devoutly believed, even during the life of the prophet, and hundreds might have been found, who on their oath would have attested these manifestations of his supernatural gifts.‡ Even in later days, when the people may be supposed more instructed, it seemed to matter little who worked a wonder, so that there was a wonder to be believed and attested. In the reign of Al Mohdi, the third Calif of Abbas, about one hundred and sixty years after the flight of Mahomet, "Hakem, or Al Mokanna, made a great many proselytes at Nakshat and Kash, by deluding the people with several juggling performances, which they swallowed for miracles; and particularly by causing the appearance of a moon to rise out of a well for many nights together." * Unlike the contemporary Christian writers, who sincerely believed many of these wonderful circumstances, and with ignorant simplicity ascribed them to the devil, the better instructed observer of modern days would consider it more likely that the ignorant should have been deceived, and the interested dishonest, than that nature should have been turned from her course, and her laws suspended for the gratification of evil demons.

The child thus magnificently favoured was nevertheless exposed to the miseries of want, and reduced to receive his education and subsistence from the charity of his uncle. At the early age of six years he lost his mother, Amena; and two years after, his grandfather Abdol Motalleb, who when dying earnestly confided the helpless orphan to the care of Abu Taleb, the eldest of his sons, and the successor to his authority. From him, though treated with kindness, Mahomet received a scanty education; but whether that education was equal or inferior to that of his countrymen, it is not easy to discover. Tradition states that at the time of Mahomet's first declaration concerning his mission, only one man in Mecca could write. If so, it is nothing wonderful that Mahomet, like the rest of his kindred, should also be unable to write†.

* According to some authorities, he died before the birth of his son. Gagnier says *after* (Vie de Mah., p. 84.) Abulpharagius states, that the father died two, the mother six, years after his birth. (Pocock's Trans., p. 6.)

† Sale, Prel. Disc., p. 183.

‡ Gagnier, Vie de Mah. pp. 77—83. These different prodigies are said to have been reported by the prophet's mother. Among the instances of credulity or dishonesty of the eye-witnesses of Mahomet's miracles, the following is a curious specimen. Ali, surnamed the Lion of God, was said to have torn from its hinges the gate of a fortress, and used it for a buckler. Abu Rafe, the servant of Mahomet, is said to affirm, that he himself, and seven others, afterwards tried, without success, to move the same gate from the ground. Abulfeda, p. 90. Abu Rafe was an eye-witness, but who will be witness for Abu Rafe?—Gibbon's Dec. and Fall, c. 50.

* Sale's Pre. Disc. p. 241.

† The story nevertheless seems improbable. It appears (Mod. Univ. His., b. 1. p. 246) that Ebn Ali Taleb, the son of Abu Taleb, and the cousin of Mahomet, was one of the prophet's scribes. How did it happen that Abu Taleb was able to have his son taught, and not his nephew? The number of the prophet's scribes proves the art of writing to have been no extraordinary acquirement. At Medina the art was common; and as there seems to have been a constant communication between that city and Mecca, it appears incredible that so useful a piece of knowledge should not have been communicated from one to the other. Mecca being also a place of

Of the infancy, childhood, and youth of Mahomet, we know almost nothing. The blank in his history has, indeed, been supplied by fable—fable, created by the pious reverence of his followers. Wonderful stories of his wit, and of his favour with the Almighty, are lavishly recorded by the Arab historians. They are, moreover, as well attested as such stories usually are; the impartial historian, nevertheless, has but one course to pursue, viz., to reject them. It is more probable that the witnesses were false swearers, or confiding dupes, than that such tales should be true. Being destined by his uncle to the profession of a merchant, it is probable that his early life was passed in acquiring the knowledge then thought necessary to that profession. Concerning this point, however, we have not one particle of evidence. At thirteen years of age, indeed, he is said to have made a voyage to Syria, in the caravan of his uncle, and, some years after, to have performed the same journey in the capacity of factor to his mistress Cadijah*. On this simple circumstance his friends and his enemies have not failed to engraft a monstrous mass of absurdity and fable. Tradition states, that at Damascus he met with a Nestorian monk, from whom he derived important information respecting his future conduct in propagating his new religion. To believe that a child of thirteen, or a youth of twenty (for he could have been little more even during his second voyage,) had conceived the idea of a new religion, and formed a plan for propagating it, argues credulity that would appear utterly impossible, did we not know that no opinion, however extravagant, is rejected, when a suitable motive is held out to believe it. The early Christian historians of Mahomet's actions were desirous of stripping the impostor of every particle of worth. His religion was not only imputed to him as the most heinous of sins, but whatever applause might be his due, for the composition of the Koran, was to be transferred to another; and a Christian monk was thought the most eligible person to receive the honour. The Arabians preserved an absurd tradition, concerning a prophecy by a monk of Damascus, relative to the future greatness and virtue of the prophet. "When he (Mahomet) arrived at Bosra, a certain learned monk, whose name was Bohira, came out of his cell, pressed through the middle of the crowd, and, seizing his hand, exclaimed, 'There will be something wonderful in this boy; his fame will spread through the East and West; for, when he approached, he appeared covered with a cloud*.'" This pious tale, which possibly the faithful Mussulman devoutly believed, and related, for the honour of his prophet, has formed the groundwork for a story equally incredible, invented for the purpose of depreciating his merits; this being the monk, who is said to have instructed Mahomet in the doctrines of the Christian religion; to have laid a plan, in concert with the future impostor, for creating a new religion, which plan was not to be carried into execution till twenty years afterwards; and to have also composed the most valuable portion of the Koran. When Mahomet performed his first journey to Syria, with his uncle's caravan, he was, according to the best authorities, not above thirteen. His second was accomplished some time previous to his marriage (he married at five and twenty,) and, during this latter journey, he acted as factor for his mistress Cadijah, conveying her goods to the fairs of Bosra and Damascus. During both journies he was ignorant of the Syrian language; both journies were journies of business; the time spent on them was, of necessity, exceedingly short; little, therefore, could have been afforded either to learn the language or converse with the inhabitants. Whatever merit there may be in the composition of the Koran (and assuredly it is exceedingly small,) it cannot, on this evidence, be transferred to the monk Bohira†.

There was no need, however, for an improbable fiction to account for the knowledge which Mahomet possessed, even supposing that necessity would not have taught him all that the Koran

traffic, the merchants must have hourly felt the want of some mode of recording their transactions. We suspect that the desire of saving their prophet from the accusation of being more ignorant than his countrymen has given rise to the above-stated tradition. Mahomet, in the Koran (c. 2. p. 52), commands all bonds to be made in writing; this could not have been done if writing had been an uncommon art. It is said, however, that a kinsman of Cadijah, Mahomet's wife, taught the prophet's scribes the Hebrew character. (Pocock's notes to Abulpharagius, p. 157.)

* Gagnier, b. i., c. 1, p. 94.

* Abulpharagius, Pocock's Trans., p. 9.

† This monk had many names. Caab and Sergius were among his other cognomens. See Bayle, Art. Mah., note V.

established. "Though the Jews," says Sale, "were an inconsiderable and despised people in other parts of the world, yet in Arabia, whither many of them had fled from the destruction of Jerusalem, they grew very powerful, several tribes and princes embracing their religion; which made Mahomet at first show great regard for them, adopting many of their opinions, doctrines, and customs; thereby to draw them, if possible, into his interests." From the same excellent authority, we learn the Arab Christians to have been exceedingly numerous, and greatly given to heresies; some of them, indeed, going so far as to believe "that the soul died with the body, and was to be raised again with it, at the last day*." They appear, moreover, to have delighted in disputations, and to have given birth to the heresies of Ebion, Beryllus, the Collyridians, and the Nazaræans†. This diversity of sects is evidence of a general knowledge of the Christian faith. "The Jews and Christians were people of the *book;* the bible was already translated into the Arabic language, and the volume of the Old Testament was accepted by the concord of these implacable enemies‡." These circumstances sufficiently account for Mahomet's knowledge of the Jewish and Christian religion.

The next remarkable event in the life of Mahomet is his appearance in the character of a soldier. At the early age of fourteen§, he served under his uncle, who commanded the troops of his tribe, the Koreish, in their wars against the rival tribes of Kenan and Hawazan. The circumstance is worthy of remark, as illustrative of an observation we made in a former section, upon the perfect compatibility between the business of a merchant and that of a soldier, amongst the Arabian people, and upon the constant and rapid transition from one to the other.

By the assistance of his uncle he became soon after the factor of a rich trading widow in his native city. The animosity of his enemies has degraded the confidential agent into a driver of camels. It has been confidently and constantly asserted, that he was a menial servant in the household of his mistress, Cadijah; while, in truth, he was employed to carry on her mercantile transactions and to superintend her affairs. Two things are deserving of observation in this falsification of history: the one, the proof it affords of the utter worthlessness of the Greek Christians as historical guides; and the second, the no less convincing evidence it furnishes of their incapacity for correctly estimating the moral worth of any human being, since the humbleness of a man's employment is by them adduced as a circumstance of moral degradation. In this situation of factor, his conduct and integrity gained him the affections of his mistress. Cadijah was not in the eyes of her people degraded by an alliance with the grandson of their prince; and in her own estimation, by bestowing her hand and fortune upon Mahomet, she gained a young, handsome, and affectionate husband. Twenty years of constancy, of kind and respectful attention, on the part of Mahomet, fully justified her choice. It may indeed be imagined, and we confess the supposition bears the appearance of some plausibility, that the affection of Cadijah was not uninfluenced by the handsome person and insinuating eloquence of her youthful suitor. And we cannot refuse our applause to the conduct of Mahomet, who, whatever might have been her motives, never afterwards forgot the benefits he had received from his benefactress, never made her repent having so bestowed her affection, or grieve at having placed her fortune and her person at his absolute disposal. Cadijah, at the time of her marriage, was forty; Mahomet, twenty-five years of age*. Till the age of sixty-four years, when she died, did Cadijah enjoy the undivided affection of her husband; "in a country where polygamy was allowed, the pride or tenderness of the venerable matron was never insulted by the society of a rival. After her death he placed her in the rank of the four perfect women; with the sister of Moses, the mother of Jesus, and Fatima, the best beloved of his daughters. 'Was she not old?' said Ayesha,† with the insolence of a blooming beauty; 'has not God given you a better in her place?'—'No, by God!' said Mahomet, with an effusion of honest gratitude, 'there never can be a better! She believed in me, when men despised me;

* Sale, Prel. Disc., sec. 2, pp. 46, 45.
† Idem. Ibid.
‡ Gibbon, Decl. and Fall, c. 50.
§ Prideaux says twenty, Gagnier also, Abulfeda fifteen.

* Prideaux says twenty-eight, Abulpharagius the age mentioned in the text. Pocock's Trans., p. 9.
† One of his wives, married after the death of Cadijah.

she relieved my wants, when I was poor and persecuted by the world*.' "

Commerce now occupied his attention, and till the age of forty nothing remarkable happened in the life of the future prophet†. His marriage with Cadijah raised him to an equality with the first citizens of Mecca, gave an importance to his opinions, and, combined with the power of his family, probably rendered it impossible to punish or interrupt the first steps he made towards the propagation of his new religion. When relieved from the pressures of indigence, his mind seems almost immediately to have been turned towards religious meditation‡. The result of this meditation was an opinion exceedingly unfavourable to the religion of his countrymen. The first statement of this conviction was met rather by ridicule than anger, being considered the phantasy of a dreaming enthusiast, who was little to be dreaded, and unworthy of opposition§. We are told that he retired to a cave in Mount Hara, near Mecca, where, as he assured his first proselyte, his wife, he regularly received the visits of the angel Gabriel. Retiring to solitude has been a common custom with religious enthusiasts. At a distance from the distractions of men, they profess to be able to contemplate more intently the works of the Divinity, and to dedicate themselves more completely to his holy service. Enthusiasts, also, have often fancied themselves favoured by visions; to have had converse with spiritual beings; and to have received comfort and instruction at their hands. The artful impostor, however, who endeavours to palm himself upon the world as one of these pious and self-immolated victims, does not fail to imitate their conduct. To distinguish the madman from the impostor, is almost beyond the power of human investigation. Whether Mahomet at this period of his life were an impostor has often been discussed, and the question usually decided according to the pre-existing leanings of the disputants—they who are inclined to look favourably upon him, deeming him a deluded enthusiast, while his enemies have denounced him as an impostor: the latter advancing in favour of their opinion, the intrinsic absurdity of the thing itself; as also his after conduct, which bore evident marks of being dictated by interest and not by enthusiasm. Had he commenced an enthusiast, say they, he would have continued one. Those, however, who have looked with more favour on the prophet, allege the many otherwise good and wise men who have fancied themselves divinely inspired. A heated imagination is by no means uncommon; and an ignorant man finds no readier dupe than himself. Moreover, to bear up against the contumely and indignation of one's fellow-citizens, to brave imprisonment, the loss of fortune and life, requires a determination that few things except an honest conviction are likely to inspire*. Neither do they allow that he who was an impostor necessarily commenced one. The temptation to preserve a power unexpectedly obtained may be too strong for the honesty of a man, whom adversity, in its most appalling shapes, cannot compel to swerve from the honest path. Mahomet, in the cave of Hara, the persecuted preacher of a despised religion, might have been a deluded enthusiast, though on the throne of Arabia he was a cunning and consummate politician. Between these contending probabilities who shall determine?

The pretended visits of the angel Gabriel, however, seemed to have been followed by no results worthy of so splendid a messenger. The information which Mahomet affirmed that he derived from his heavenly visitant might, as far as regarded its utility, have been obtained through the instrumentality of a much more humble personage. On the night of the 23d of *Ramadan*, called in the Koran the night of Al Kadr, or the *divine decree*, the KORAN first descended from the seventh to the lowest heaven; and at a distance from the pious Mahomet appeared the brilliant form of the messenger of God, the angel Gabriel, who came to communicate the happy tidings. The light issuing from his body was too bright for the mortal eyes of the prophet; he fainted, and not till the angelic visitant had assumed a human form could he venture to ap-

* Gibbon, Decl. and Fall, c. 50, p. 151.

† Mod. Univ. Hist., b. i., c. 1, p. 31. Gagnier, Vie de Mah., b. i., c. 6, p. 103.

‡ Gagnier, b. i., c. 6, p. 104. The story of his fainting fits at this period of his life, and of his turning them to his profit by declaring them trances, in which he enjoyed the company of the Divinity, Gagnier asserts to be a fable invented by the earlier Christian writers.

§ Mod. Univ. Hist., b. i., c. 1, p. 42, and the original authorities there quoted.

* It must be remembered that suffering for an opinion is no proof of its *truth*; but is merely some evidence that he who suffers honestly believes that which he professes to believe.

proach or look on him. The angel then cried aloud, "O! MAHOMET, THOU ART THE APOSTLE OF GOD, AND I AM THE ANGEL GABRIEL." "Read," continued the angel; the illiterate prophet declared that he was unable to read. "Read!" Gabriel again exclaimed, "read, in the name of the Lord, who hath created all things; *who hath created man of congealed blood;* who hath taught the use of the pen; who teacheth man that which he knoweth not." The prophet read the joyful and mysterious tidings respecting his ministry on earth, when the angel, having accomplished his mission, slowly and majestically ascending into heaven, gradually disappeared from his wondering gaze*. This tale was by Mahomet related to his wife, who believed, or affected to believe, the sacred fable†. The next on the list of true believers were Zeid, the servant of the prophet, and ALI, the son of his uncle Abu Taleb. The impetuous youth, disdaining his two predecessors in the true faith, proudly styled himself the first of believers. The next and most important convert was Abubeker, a powerful citizen of Mecca, by whose influence a number of persons possessing great authority were induced to profess the religion of Islam. Three years were spent in the arduous task of converting six of these men. They were afterwards his chief companions, and with a few others were the only proselytes to the new religion before it became publicly known‡.

The mission of Mahomet had hitherto been secret, the time was now arrived at which the Lord commanded him to make it known §. To this end he convened a large number of his kindred to a feast; forty of whom assembled round his board. The prophet rose, and thus addressed his wondering kindred:—"I know no man in the whole peninsula of the Arabs, who can propose to his relations any thing more excellent, than what I now do to you. God Almighty hath commanded me to call you unto him; who, therefore, among you will be my vizir, or assistant, and become my brother and vicegerent?" General astonishment kept the assembly silent; none offered to accept the proffered office, till the impetuous Ali burst forth, and declared that he would be the brother and assistant of the prophet. "I," said he, "O prophet of God, will be thy vizir; I myself will beat out the teeth, pull out the eyes, rip open the bellies, and cut off the legs, of all those who shall dare to oppose thee." The prophet caught the young proselyte in his arms, exclaiming, "This is my brother, my deputy, my successor; shew yourselves obedient unto him." At which apparently extravagant command, the assembly broke up in confusion, testifying their mirth and astonishment by bursts of laughter*.

Not discouraged by the failure of this his first public attempt, Mahomet began now to preach openly before the people. He discovered to them that he was commissioned by the Almighty to be his prophet on the earth, to assert the unity of the Divine Being, to denounce the worship of images, to recall the people to the true and only religion, to bear the tidings of paradise to the believing, and to threaten the deaf and unbelieving with the terrible vengeance of the Lord †. His denunciations were efficacious; as they were well fitted for the imaginations of an ignorant people. "Because he is an adversary to our signs, I will afflict him with grievous calamities; for he hath devised contumelious expressions to ridicule the Koran—may he be cursed. How maliciously hath he prepared the same!—may he be cursed. I will cast him to be burned in hell. And what shall make thee understand what hell is? It leaveth not any thing unconsumed, neither doth it suffer any thing to escape; it scorcheth men's flesh: over the same are nineteen angels appointed. We have appointed none but angels to preside over hell-fire." . . . . . . . "Verily, we have prepared for the unbelievers chains, and collars, and burning fire." . . . . . "Verily, those who disbelieve our signs, we will surely cast out to be broiled in hell-fire: and when their skins shall be well burned, we will give them other skins in exchange, that they may taste the sharper torment ‡." These terrible sufferings were to be the lot of the wicked—the wicked were those whom Mahomet disliked. "Those who dwell in gardens, *i.e.* paradise, shall ask one another questions concerning the wicked, and shall ask the wicked themselves, saying, what hath

* Mod. Univ. Hist., b. i., c. 1. p. 44. Gagnier, b. i., c. 7, p. 104—109. Koran, c. 96.

† Bayle, art. Mahomet. Gagnier, b. i., c. 8.

‡ Sale, Prel. Disc., p. 57.

§ God commanded "him to arise, and preach, and magnify the Lord." Koran, c. 74. Gagnier, b. i, c. 9, pp. 112, 119.

* Sale, Pre. Disc., s. 2, p. 57. Mod. Univ. Hist. b. 1, c. 1, p. 47.

† Koran, c. 78, p. 472, Sale's trans.

‡ Koran, c. 74, p. 470, c. 76, p. 474, and c. 4, p. 10.

brought you into hell? They shall answer, we were not of those who were constant in prayer; neither did we feed the poor; *and we waded in vain disputes*, with the fallacious reasoners; and we denied the day of judgment, till death overtook us: and the intercession of interceders shall not avail them. What aileth them, therefore, that they turn aside from the admonition of the KORAN? *" To deny the efficacy of the Koran; to dispute upon the truth and reasonableness of his mission, were naturally in Mahomet's eyes the most heinous sins. By his friendly voice the people were warned of the dangers of disbelief; and besought by his moving eloquence to avoid eternal damnation, by putting faith in the APOSTLE OF GOD.

Among the most strange of Mahomet's stories promulgated at this period of his life, was the tale of his admission into the seven heavens, under the guidance of the angel Gabriel; through whose care and diligence he had been enabled in the course of one night to behold all the wonders of the heavenly regions, and to converse with the Almighty himself. The account which tradition has handed down of this extravagant fable is a tissue of the most dull and ridiculous absurdities; a story, in short, as destitute of fancy as of skill. We may easily suppose that a man of a poetic imagination could have composed a description of a journey through the boundless and glorious regions of heaven, captivating and misleading the minds of his hearers, by its splendid imagery, its gorgeous and startling embellishments. We may conceive him to have possessed them with vague and indefinite, but still with vast and wondering, conceptions of the magnificence of the celestial kingdom; of the power and beauty of its inhabitants; of its own dazzling and unspeakable glories. A well managed description, of such a character, might have had a powerful effect upon a rude and sensitive people. But the description which tradition has handed down, as given by Mahomet of his celestial journey, possesses no such poetical merits. He has described every thing upon a most extravagant scale; but unwisely endeavours to convey *definite* conceptions of the marvels he pretended to have witnessed. He relates by rule and measure, leaving nothing to the imaginations of his hearers. —This was so long—that so broad—this had so many eyes—this so many tongues;—and while he thus strives to swell the imagination by mere arithmetic, he renders himself and his description ridiculous. In the first heaven he saw a cock so large that his head reached to the second heaven, which was at the distance of five hundred days' journey, according to the common rate of travelling on earth; his wings were large in proportion to his height, and were decked with carbuncles and pearls; he crows so loud every morning, that all the creatures on earth, except men and fairies, hear the tremendous sound. The second heaven was all of gold; and one of the angels who inhabited it was so large, that the distance between his eyes was equal to the length of seventy thousand days' journey. In the seventh heaven was an angel having seventy thousand heads, in every head seventy thousand mouths, in every mouth seventy thousand tongues, in every tongue seventy thousand voices, with which day and night he was incessantly praising the Lord. Such were the puerile conceptions of the prophet! Of this famous journey we shall give no further account; a more stupid fable it is impossible to conceive; and which, were it not evidence, would have deserved no mention by the historian. It satisfactorily proves three things, however, the poverty of the prophet's invention; the unbounded extent of his impudence; and the extraordinary credulity of his followers.

The fable at first met with no favourable reception; its extravagance and its absurdity were a little too glaring to be immediately, and without trouble, acquiesced in. Not till Abubeker had declared his complete and implicit reliance in the truth of the sacred fable, did the votaries of the prophet venture to distrust their understandings, and put faith in the astounding assertions of the holy man. Their faith was doubtless quickened by his furious denunciations of eternal torments against all who dared to disbelieve the sublime and miraculous adventure: terror was the result of these denunciations, proclaimed with vehemence and unblushing effrontery; and belief naturally followed in the train of terror. And thus the extravagant lie, which at first threatened the rising religion with early destruction, served, by a happy combination of circumstances, to contribute materially to its success *.

* Koran, c. 74, p. 471.

* They who desire to have a full description of this wonderful tale may consult Gagnier, who is peculiarly minute. Prideaux, moreover, does not let slip the

The apostle, who was at first derided, came at length to be feared. The people flocked to hear his doctrines, and as they retired, wondering and believing, general consternation reigned among the governors of Mecca. Frightened by his growing influence they imprudently endeavoured to arrest the evil, by punishing the offender. For some time, however, the power of Abu Taleb, the prophet's uncle, defended him against these hostile attacks, which served, by manifesting the alarm and hatred of the nobles, to increase Mahomet's fame and importance. Persecution gave him strength, by bringing him before the public. Once known, he gained sympathising listeners among the benevolent, because a persecuted man; and blindly believing votaries among the ignorant and fearful, because a bold and vehement declaimer against wickedness, as well as an eloquent describer of the horrible torments attached to unbelief. In the seventh year of his mission, the heads of the tribe of Koreish made a solemn league with one another, engaging themselves to have no commerce or connexion with the families of Hashem and Al Motalleb. While Abu Taleb lived the league was of no avail; the power of the uncle defended the nephew against the design of his enemies. At length at the end of the seventh year Abu Taleb died; and a few days after his death Mahomet was left a widower, by the decease of Cadijah. In his affliction he termed this fatal year the year of mourning *.

The unprotected prophet was now completely exposed to the attacks of his enemies. His only safety was in flight, and had not the city of Medina been friendly to his case, the religion of Islam would have been crushed in the bud. The fame of Mahomet, however, had extended far beyond the walls of his native town. Distance, by shrouding him in mystery, increased his influence. While he was scorned at,—derided at Mecca, he was worshipped at Medina*. A secret deputation from the city of Medina waited on the apostle, and an alliance was entered into "during two secret and nocturnal interviews, on a hill in the suburbs of Mecca †." Seventy-three men, and two women, having professed the faith of Islam, as well as some yet unbelievers, met the prophet and proffered him assistance. "What recompense," said they, "have we to expect should we fall in your defence?" "PARADISE," exclaimed the confident apostle. They promised him fidelity and allegiance.

Abu Sophyân succeeded Abu Taleb in the government of Mecca. In him Mahomet found a mortal enemy to his family, his religion, and himself. The idols, against which Mahomet had preached, were, by Abu Sophyân, devoutly revered; and the new religion abhorred as an incentive to the most horrible sacrilege. No sooner was he called to the head of the state than he determined to exterminate both the apostle and his religion. A council of the hostile Koreish was convened, and the death of Mahomet decided‡. The prophet declared that the angel Gabriel had revealed to him the atrocious conspiracy. We may safely suppose, nevertheless, that a human spy revealed the secret. However obtained, the information determined Mahomet to seek safety in flight; but so closely was he watched by his enemies, that he escaped only through the devoted zeal of Ali, who, wrapped in the green mantle of the apostle, lay down upon his bed and deceived the assassins, who besieged the house of his friend. Our applause is due to the intrepidity of the youthful zealot, even though he was zealous in favour of error. He who is willing to offer up his life in defence of the principles he deems correct, has made one important step towards being a perfect character; he has the *will* even if he have not the *knowledge* to be virtuous. Mahomet, in the mean time, with his faithful friend, Abubeker, escaped to the cave of Thor, three miles from Mecca, and there hid himself three days from his pursuers. A cherished tradition of the Arabs states, that the pursuers having arrived at the mouth of the cave, were deceived by the nest of a pigeon

opportunity of dealing in the marvellous, and of abusing the prophet. The ridiculous stories which Mahomet coined for himself have not been considered sufficient. Some persons, probably the Greek Christians, forged a host of others; among which, that of a pigeon being always seated on the prophet's shoulder, and communicating to him past, present, and coming evils, holds a conspicuous station. To this Pope alludes in the line—

"Nay, Mahomet, the pigeon at thine ear."
DUNCIAD.

See Bayle, Art. Mahomet, rem. v.; and Pocock, not. in Spec. Arab. p. 186.

* Sale, Pre., Dis. sec. 2, p. 60. Abulfeda, p. 28.

* Mod. Univ. Hist., b. 1, c. 1, p. 84.

† Gibbon, Dec. and Fall, c. 50. Sale, Pre. Dis., s. 2, p. 63. Abulfeda, Vit. Moh. p. 40.

‡ D'Herbelot, Bib. Orien., p. 445.

made at its entrance, and by a web which a spider had fortunately woven across it; believing these to be sufficient evidence that no human being was within, they desisted from all further examination. Mahomet and Abubeker left the cave upon the departure of their enemies, and after a toilsome journey, arrived in safety at the friendly city of Medina. This flight of their prophet has become the Mussulmans' æra, the well known *Hejdira* of the Mohammedan nations*.

From a fugitive Mahomet became a monarch; no sooner had he arrived at Medina, than he found himself at the head of an army devoted to his person, obedient to his will, and blind believers in his holy office. The *fugitives* from Mecca, and the *auxiliaries* of Medina, (the two parties into which Mahomet's followers were now divided) gathered round their chief, and with friendly emulation vied with each other in obedience and in valour. To prevent all jealousy between the brethren, Mahomet wisely gave each one a friend and companion from the rival band; each *fugitive* had for his brother one of the *auxiliaries*. Their fraternity was continued in peace and in war, and during the life of the prophet their union was undisturbed by the voice of discord.

The first act of Mahomet after his arrival at Medina shows at least his policy, perhaps his devotion. He built a temple in which he might celebrate the offices of his religion, and publicly pray and preach before the people. The land upon which this temple or mosque was built belonged to two orphans; and the enemies of Mahomet have not failed to assert that he despoiled the helpless children of their property. The accusation, however, has been vehemently denied, and we cannot but feel that in a stranger, in one depending entirely upon public estimation for his defence, it would have been the height of impolicy to have committed such an act at such a time. That Mahomet was a deep politician, no one has doubted; that to have robbed two orphans of their property would have rendered him and his religion unpopular is, we think, equally indisputable. How then can we believe him to have erred so egregiously at so critical a moment †?

* Hejdira, in Arabic, signifies *flight*. According to most authorities it happened 16th July, A. D. 622. Bayle, art. Mah. Mod. Univ. Hist., b. 1, c. 1, p. 98.

† Sale, Pre. Disc., sec. 2, p. 67. Gibbon's Dec. and Fall, c. 50, p. 127. Prideaux, Vie de Mah. p. 86.

He now, in his own person, combined both the temporal and religious power; he was general of his armies, the judge of his people, and the religious pastor of his flock *. And so intense was the devotion of his followers, that his spittle, a hair that dropped from his person, the water in which he washed himself, were all carefully collected and preserved as partaking of the apostle's holy virtue. The deputy of the city of Mecca beheld with astonishment this blind and devoted obedience and veneration. "I have seen," said he "the Chosroes of Persia, and the Cæsar of Rome, but never did I behold a king among his subjects like Mahomet among his companions."

While the religion of Islam † had more to fear than to hope from persecution, the precepts of Mahomet breathed humility and benevolence. "Let there be no violence in religion," was the command of the prophet in Mecca ‡; but in Medina, when at the head of an army, and able to combat with his enemies, he assumed a widely different tone. "O true believers! take your necessary precaution against your enemies §, and either go forth to war in separate parties, or go forth all together in a body. . . . Let them, therefore, fight for the religion of God, who part with the present life in exchange for that which is to come; for whosoever fighteth for the religion of God, whether he be slain or victorious, we will surely give him great reward." . . . "And when the months wherein ye are not allowed to attack them, *i. e.* unbelievers, shall be passed, kill the idolaters, wheresoever ye shall find them, and take them prisoners, and besiege them, and lay wait for them in every convenient place ||." The commands of the prophet were followed to the letter. The first warlike attempt of the believers was, nevertheless, unsuccess-

* Koran, c. 4, p. 107.

† Islam. The proper name of the "Mohammedan religion, which signifies the resigning or devoting one's self entirely to God and his service." Sale, Koran, c. 3, p. 57. See also Pre. Dis., s. 4. p. 92. Moslem. Musulman. "The Arabic word is Moslemûna, in the singular Moslem, which the Mohammedans take as a title peculiar to themselves. The Europeans generally write and pronounce it Musulman." (Sale, Kor. c. 2, p. 24.) Both words have the same meaning as Islam, and are derived from the same root.

‡ Koran, c. 2, p. 48.

§ This is explained by Sale to mean, be vigilant, and provide yourselves with arms and necessaries. Koran, c. 4, p. 107; and Sale's note.

|| Koran, c. 4, pp. 108, 109, c. 9, p. 238. The command to war against the enemies of the faith is repeated in chapters 2, 4, 8, 9, 22, and 47. See also Sale, Pre. Disc., p. 188.

ful. Mahomet having learned that a caravan, the property of the hostile Koreish, was on its way from Syria to Mecca, dispatched his uncle, Hamza, with a party of thirty horse to capture it. Hamza, however, discovering the caravan to be guarded by three hundred men, desisted from his hostile enterprise, and returned without the expected booty. On the plain of Beder, Mahomet, at the head of his troops, effaced the shame of this failure. A rich caravan proceeding to Mecca, and guarded by Abu Sophyân, with between thirty and forty men, occasioned the contest. The spies of Mahomet informed him that this rich and apparently easy prey was within his grasp. He advanced with a few followers in pursuit of it; but before he could overtake the unprotected band, Abu Sophyân had sent for a reinforcement from Mecca. A troop, consisting of nine hundred and fifty men, among whom were the chief persons of the city, instantly obeyed the summons. Mahomet was posted between the caravan and the coming succour, being able to oppose to this formidable force no more than three hundred and thirteen soldiers, mounted for the most part on camels; some few (according to some authors, not more than two) being mounted on horses. Undismayed by this disparity of force, Mahomet determined to try the event of a battle, and risk his fortune and perhaps his life upon the contest. The troops were persuaded to engage the superior forces of the enemy, and for the present to abandon the tempting prize of Abu Sophyân's rich caravan. Mahomet animated them by his prayers, and in the name of the Most High promised them certain victory. However assured he might have been of divine assistance, he was careful to let slip no human means of securing success. An entrenchment was made to cover the flank of his troop, and a rivulet flowed past the spot he had chosen for his encampment, and furnished his army with a constant supply of water. When the enemy appeared descending from the hills, Mahomet ordered his soldiers to the attack; but before the armies could engage, three combatants, Ali, Al Hareth, and Hamza, on the side of the *Moslems*, and three of the Koreish, joined in single conflict. The Moslem warriors were victorious, and thus gave to both armies a presage of the coming engagement. The prophet, with Abubeker, at the commencement of the battle, mounted a pulpit, fervently demanding of God the assistance of Gabriel, and three thousand angels *; but when his army appeared to waver, he started from his place of prayer, mounted a horse, and flinging a handful of dust into the air, exclaiming, "May their faces be confounded," rushed upon the enemy. Fanaticism rendered his followers invincible; the numerous forces of the Koreish were unable to break the ranks or resist the furious attacks of his confiding soldiers. They fled, leaving seventy of their principal officers dead upon the field, and seventy prisoners in the hands of the enemy*. Of the Moslems, only fourteen were slain: the names of the slaughtered warriors have been handed down to posterity, and enrolled among the list of pious martyrs, whom the faithful Mussulman is taught to worship. The victorious army stripped the dead bodies of their enemies, insulted, and threw them into a well. A more convincing proof of their barbarity and ignorance could not have been desired. The child in his anger beats the inanimate object of his displeasure; the savage, equally ignorant, and unable to conceive the lifeless corse wholly destitute of will and consciousness, satisfies his ferocious vengeance, and exercises his brutal ingenuity on the inanimate trunk of his adversary. Only two of the prisoners, however, were sacrificed to the anger of the prophet. Al Nodar, and Okba, at his command, suffered death by the hand of Ali, the remainder were afterwards ransomed by their relations. Part of the caravan was captured, but the greater portion arrived safely at Mecca†. The spoils, however, arising from the ransom of the prisoners, and the partial plunder of the caravan, amounted to a considerable sum; the fifth part taken for the prophet's share, being no less than twenty thousand dirhems of silver‡.

The Moslems now hoped to remain at peace; and for some time their expectations were fulfilled. Tradition says that

* Sale, note *d*. Koran, c. 3, p. 56.

* Mod. Univ. Hist., b. 1, c. 1, p. 108.
† *Ib*. b. 1, c. 1, sec. 2, p. 110.
‡ Gibbon's Dec. and Fall, c. 50, p. 132. It would seem that this sum was obtained in a subsequent capture, and not from that of Abu Sophyân's caravan, the greater part of which escaped at the battle of Beder. Mod. Univ. Hist., b. 1, c. 1, sec. 2, p. 118. Dirhem. "A dirhem and a-half weighs a drachm; so that there are twelve to an ounce, weighing eight drachms." D'Herbelot, Bib. Orient. Art. *Dirhem*.

the disturber of this happy tranquillity was a Jew, the son of Al-Ashraf, by name Caab; who being a poet, deplored in touching verses the unhappy fate of those enemies of Mahomet who fell at the battle of Beder, and had the hardihood to sing his poems to the people within the walls of Medina. Mahomet, when informed of Caab's conduct, exclaimed, "Who will deliver me from the son of Al-Ashraf?" A ready instrument was not wanting: Mohammed, the son of Mosalama, answered, "I, O Apostle of God, will rid you of him." Caab was soon after murdered by Mohammed, while hospitably entertaining one of the assassin's followers. War was immediately renewed *.

In the next year, the third of the Hejira, the Koreish assembled an army of three thousand men, under the command of Abu Sophyân, and proceeded to besiege the prophet in the city of Medina. Mahomet determined to await the attack within the walls of the city. His former victory, however, had too much elated his troops to allow them to pursue this prudent course. They demanded of the prophet to be led out to battle, and he unwisely yielded to their clamorous supplication. Impelled also by the same ardour that influenced his followers, he unwarily promised them certain victory. The prophetic powers of the Apostle of God were to be estimated by the event. Mahomet in every encounter seems to have manifested in a high degree the talents of a general; his troops were always arranged in the manner best suited to the occasion, and he might fairly assert that he owed his success as much to his own intellect as to the valour of his soldiers. In the present instance, his army, consisting of about one thousand men, was advantageously posted on the declivity of a mountain, near Ohad, four miles from Medina. Three standards were confided each one to a separate tribe, while the great standard was carried before the prophet himself; and a chosen band of fifty archers were stationed in the rear with peremptory orders to remain there, till commanded to the attack by Mahomet himself. The conflict commenced by the Moslems charging down the hill, and breaking through the enemy's ranks. Victory or Paradise was the reward promised by Mahomet to his soldiers, and they strove with frantic enthusiasm to obtain the expected recompense. The line of the enemy was quickly disordered, and an instant and easy victory seemed about to crown the efforts of the Moslem troops. At this moment the archers in the rear, impelled by the hope of plunder, deserted their station, and scattered themselves over the field. Khâled, an experienced general of the Koreish, seized the favourable opportunity; and furiously charging the army of Mahomet on the flank, dispersed their disordered and unguarded flanks, and turned the fate of the day. The soldiers of Mahomet began to give way in every direction; Khâled called aloud that Mahomet was slain, and the rout became general. The prophet endeavoured in vain to rally his broken troops: he fought with desperate valour; exposed his person, where the danger appeared greatest; was wounded in the face by a javelin, had two of his teeth beaten out by a stone, was thrown from his horse, and would inevitably have been slain, but for the determined valour of a few chosen adherents, who rescued him from the throng, and bore him away to a place of safety. The day was utterly lost; seventy of his soldiers were slain, and his reputation was in imminent peril. His followers murmured, and asserted that the will of the Lord had not been revealed to him, since his confident prediction of success had been followed by signal defeat. The prophet threw the blame upon the sins of his people: the anger of the Lord, he said, had fallen upon them, in consequence of their security. The Lord had determined to try who were the true believers, who the faithless. "Did ye imagine that ye should enter Paradise, when as yet God knew not those among you who fought strenuously in his cause; nor knew those who persevered with patience *." By these miserable shifts he endeavoured to excuse the falsity of his prophecy. Abu Sophyân, however, did not pursue his success. Eastern warfare depends upon so many chances, that to account for this strange neglect is impossible. In the east the army that this week is victorious, may by the next be melted away and dispersed. They had not then, and they have not now, any mode of regular warfare. No provision is made for a long and continued plan of operations. A distant end, to be attained by means of a series of many intervening actions, is never conceived by an eastern general. He assembles a number of soldiers, and with

* Gag. Vie de Mah. pp. 351, 2.

* Koran, c. 3, p. 80.

his tumultuary army hastens to a general conflict. If successful enough to annihilate his enemy by one blow, the object of his enterprise is attained; if not, it must be referred to another and more favourable opportunity. To keep his army in the field, to feed, pay, and clothe them during a year's campaign, seems almost impossible. The different armies of the Arabs were bands hastily summoned on some sudden emergency; impelled by the hope of plunder they readily followed to the field; when defeated of their object, they as readily dispersed.

At the commencement of the next year war was again renewed, and Mahomet was now successful. The mode in which he freed himself from one of his opponents at this period, deserves to be recorded. Being informed that Sophyân the son of Khâled was collecting men for the purpose of attacking him, he ordered Abdo'llah the son of Onaïs surnamed Dhu'l-Malldhrat, that is, *a man ready to undertake anything*, to assassinate Sophyân. Abdo'llah obeyed his prophet's commands, and murdered Sophyân in the valley of Orsa. He immediately returned to Mahomet, who upon hearing the success of his enterprise, gave him in sign of his friendship the cane which he usually carried*.

We have neither space nor inclination to enumerate the various battles fought by Mahomet during the five succeeding years. Suffice it to say, that according to the computation of some authors, no less than twenty-seven expeditions were undertaken, in which he personally commanded; and in which nine pitched battles were fought †. During the same period, he was besieged in Medina, by the implacable Koreish; but, by his own skill, and the bravery of his troops, he repelled all their attacks, and eventually dissolved the confederacy into which they had entered with the neighbouring tribes. In the sixth year of the Hejira, with fourteen hundred men, he meditated what he asserted to be a peaceful pilgrimage to the holy temple of Mecca. Entrance into the city being refused by the people, the prophet, in his anger, determined to force his way. At this critical juncture an ambassador was dispatched from Mecca to demand a peace. The policy of Mahomet induced him to lay aside his determination of assaulting his native city, and to accept the peaceful offers of his countrymen. A truce of ten years was consequently concluded between the prophet and the Koreish.

Two years had hardly elapsed when Mahomet accused the people of Mecca of a breach of their engagement. When a man is really desirous of quarrelling, a pretext is never wanting. He was now strong, and his enemies were weak. His superstitious reverence for the city of his nativity, and for the temple it contained, served also to influence his determination for war. The time since the concluding of the truce had been skilfully employed in seducing the adherents of the Koreish, and converting to his religion the chief citizens of Mecca. With an army of ten thousand men, he marched to besiege it, and no sooner did he appear before the walls, than the city surrendered at discretion. Abu Sophyân, the inveterate enemy of Mahomet and his religion, presented the keys of the city to the conqueror; and yielding to the arguments enforced by the scimitar of the furious Omar, he bowed down before the prophet, and acknowledged him to be the apostle of God. Mahomet, though a conqueror, and an impostor, was not cruel; his anger was directed rather against the gods of his country, than its inhabitants. He destroyed the whole of the idols, but executed no more than three men and two women belonging to the party of his enemies. The chiefs of the Koreish prostrated themselves before him, and earnestly demanded mercy at his hands. "What mercy can you expect from the man whom you have wronged?" exclaimed Mahomet, in reply to their supplication. "We confide in the generosity of our kinsman." "You shall not confide in vain," was the politic, perhaps generous, reply of the impostor. "Be gone; you are safe: you are free." They were thenceforth left unmolested, and places of honour and trust were still confided to their care *.

We have now reached the period at which the religion of Mahomet may be considered to have been permanently settled. The conquest of Mecca and of the Koreish was the signal for the submission of the rest of Arabia †. The events of the prophet's after life cease, therefore, to possess an interest for an European reader. They were, for the

* Gag. Vie. de Mah. vol. i. p. 374.
† Sale, Pre. Disc. s. 2, p. 68.

* Mod. Univ. Hist. b. 1, c. 1, p. 171.
† Idem, b. 1, c. 1, p. 191.

most part, merely expeditions undertaken for the purpose of reducing the petty tribes who still resisted his authority; and were all of them eventually successful. The influence and religion of Mahomet continued rapidly to extend: his difficulties were over; and the hour of his prosperity has nothing to instruct or to amuse the general reader. Between the taking of Mecca and the period of his death, not more than three years elapsed. In that short period he had destroyed the idols of Arabia; had extended his conquests to the borders of the Greek and Persian empires; had rendered his name formidable to those once mighty kingdoms; had tried his arms against the disciplined troops of the former, and defeated them in a desperate encounter at Muta. His throne was now firmly established, and an impetus given to the Arabian nations, that in a few years induced them to invade, and enabled them to subdue, a great portion of the globe. India, Persia, the Greek empire, the whole of Asia Minor, Egypt, Barbary, and Spain, were reduced by their victorious arms. And although Mahomet did not live to see such mighty conquests, he laid the first foundations of this wide-spreading dominion, and established over the whole of Arabia, and some parts of Syria, the religion he had pursued.

One year before the taking of Mecca, Mahomet had been poisoned by a Jewish female at Chaibar. From the effects of this poison he is supposed never afterwards to have recovered. Day by day he visibly declined, and at the end of four years after that event, and in the sixty-third year* of his age, it was evident that his life was hastening to a close. Some time previous, he was conscious of the approach of death, and met it with firmness and composure. Till within three days of his end, he regularly performed the service of his church, and preached to his people. "'If there be any man,' said the prophet from the pulpit, 'whom I have unjustly scourged, I submit my own back to the lash of retaliation. Have I aspersed the reputation of any Mussulman? let him proclaim my faults in the face of the congregation. Has any one been despoiled of his goods? the little which I possess shall compensate the interest and principal of the debt.' 'Yes,' replied a voice from the crowd, 'I am entitled to three dramchs of silver.' Mahomet heard the complaint, satisfied the demand, and thanked his creditor that he had accused him in this world rather than at the day of judgment.*" He enfranchised his slaves, and quietly awaited the approach of death. The violence of his fever, however, rendered him delirious, and during one of his paroxysms he demanded pen and ink, to compose or dictate a divine book. Omar, who was watching his dying moments, refused his request, lest the expiring prophet might dictate anything that should supersede the Koran. The traditions of his wives and companions relate that at the hour of his death he maintained the same character he had borne through life. He declared that Gabriel visited him, and respectfully asked permission to separate his soul from his body. The prophet granted his request, and the agonies of death came upon him. The blooming Ayesha, the best beloved of his wives, hung tenderly over her expiring husband; her knee sustained his drooping head as he lay stretched upon the floor; she watched with trembling anxiety his changing countenance, and heard the last broken sounds of his voice. Recovering from a swoon, into which the agony of his pains had thrown him, with a calm and steady gaze, he raised his eyes to heaven, but with faltering accents exclaimed,—"O! God, pardon my sins. Yes, I come among my fellow labourers on high." He then sprinkled his face with water, and quietly expired. At Medina, in the very chamber where he breathed his last, the piety of his votaries deposited his remains, and erected over them a simple and unadorned monument †. Medina, on account of the precious relics of the prophet, has become sacred in the eyes of all Moslem nations, and holds the second place among the cities of the earth. And the pious pilgrim on his way to Mecca increases the worth of his pilgrimage if he turn aside to visit also the city which contains the ashes of Mahomet.

SECT. IV.—With the succeeding revolutions of the Arabian empire our

* Abulpharagius, Pocock's trans., p. 13.

* Gibbon, c. 50, p. 144.

† Concerning the absurd stories of the hanging coffin of Mahomet we shall say nothing, our space being too precious to be spent in such idle discussions. To those who are desirous of information on this point, we recommend the article MAHOMET, in Bayle, note DD. Niebuhr says, "the tomb is of plain mason work, in the form of a chest; and this is all the monument." Travels; c. 68, p. 92. Pink. Coll.

present purpose has no connexion. Our task is finished at the death of Mahomet, and all that now remains for us to perform is to estimate his character.

Mahomet found his countrymen living under certain institutions, following a certain code of morals and of law, and professing a certain rude religion. These institutions, through his instrumentality, all underwent a material alteration. Did he by this alteration improve the situation of his countrymen? and if so, to what extent did he improve it? These are the questions by which his worth must be judged; and they can be fully and fairly answered, only when we have carefully examined the institutions he framed as they severally regard the government, the laws, the religion, the morals and the manners of his countrymen. By summing up his excellencies and defects in each and all of these departments, we shall alone be able to estimate the *public* character of the man. His *private* character must be judged by his adherence to those rules of morality which his people adopted, and which his own judgment afterwards approved.

The government of his country Mahomet left as faulty as he found it. Previous to his mission the people had been subject to the sway of powerful nobles, whose dominion was uncontrolled either by established forms of government, or by established laws. The petty despotisms of the nobles were by Mahomet united under one head; but the rude mind of the barbarian was unable to conceive any other means of governing his distant provinces than to delegate his own despotic power to the governors he appointed to rule over them. The separate provinces, therefore, though they now owed obedience to one and the same distant monarch, were, nevertheless, ruled as before, each by its own petty despot. Supported by the authority of a mighty empire, and influenced in his private manners, in his expenditure and in his public conduct, by the example of his sublime original, the petty tyrant lost no particle of his mischievousness; oppression, as before, was the lot of the unfortunate multitude *.

That Mahomet established no other form of administration than the usual despotism of oriental nations, even for the central government, need not excite our astonishment. For although superior to his countrymen in the qualifications requisite to lead and impose upon a barbarous people, he was possessed of little really useful knowledge. He had just arrived at that degree of knowledge which renders a man sensible of the necessity of some government; of some person to lead the armies of his nation in war, and to adjudge their differences in peace; beyond this he had made no advance. He knew not that the same circumstances which render a governor necessary, create also a necessity that some securities should exist against the abuse of power by the governor himself. If he was thus ignorant, his merits as a legislator were of the lowest description; if he were not, he was culpably indifferent.

The glare and pomp of constant victory, and wide-spreading conquests, are too often able to attract the admiration, and to disturb the judgment of the historian. Whenever a nation has been induced to unite its energies, and to direct them to the annoyance and destruction of its neighbours, it is usually thought that its government has of necessity been improved, and its people rendered happy and prosperous. To him, however, who will coolly investigate the causes of a nation's prosperity, war, in every shape, must appear the most tremendous of human miseries. The happiness of a people depends upon means of enjoyment, which, in by far the greater number of cases, are the produce of industry: industry employed in deriving from the soil the productions of nature, and fashioning them for use according to our several wants and desires. But the devastations of war disturb the peaceful vocations of the industrious artisan and agriculturist; its expenses swallow up the produce of their labour; that which ought to be employed in reproduction is thrown away in the maintenance of armies; and while the glory of the nation is increased, while the wreath of victory is, by vulgar admiration, placed upon the brows of its warriors, the people are reduced to starving and the triumphs of the successful general are purchased by the misery of millions. Those who have admired the mighty conquests of the Arab prophet have seldom been at the

* A more abominable race of governors never existed than the lieutenants of the Caliphs, who succeeded Mahomet. A history of their cruelties may be found in Ockley's Hist. of the Saracens, vol. ii. reign of Moawiyah I.

pains to learn whether the *people* of Arabia were made happy by those conquests, or whether the nations subdued by his victorious arms had *their* welfare increased by having their fields overrun, and their towns destroyed by his ferocious followers. What is usually termed the increased national greatness of Arabia, that is, its increased power of subduing and destroying its neighbours, entitles Mahomet to no respect.

### KORAN.

The Koran must be considered as the code of laws, religion, and morality, which Mahomet, in his character of legislator, promulgated to the people of Arabia. It contains almost every thing he left behind him in the shape of precept and instruction; and such as it is, was supposed by him, and is still thought by his followers, to comprise all the information that is requisite for the happiness of mankind. "It must be remarked, that, as the Alcoran is among the Mussulmans the only book of law, it consequently comprehends all their civil, and, to speak according to our own phraseology, all their canon law. And as it comprehends also the truths which they ought to believe, it follows that a doctor in the law is, according to them, a doctor in theology, and that the two professions of law and theology are amongst them inseparable.

"This law, upon which is founded all the theology and all the jurisprudence of the Mussulmans, is then comprised in the Koran, in the same manner that the law of the Jews is comprised in the Five Books of Moses *."

When Mahomet first laid claim to divine inspiration, he cunningly contrived to obtain in reality the power of making laws. In name, indeed, he was but the instrument by which the divine decrees were made known to the world. He informed his followers, and they believed him, that in the seventh heaven there had been from everlasting a large table, called the *preserved table*, on which were recorded the commands of the Almighty. From this table a copy had been taken, and conveyed by the angel Gabriel to the lowest heaven, on the night of the *divine decree*. From this copy, as Mahomet's necessities required, fragments were conveyed by inspiration to the prophet, and by him were announced to his followers. As might have been expected, they were connected intimately with Mahomet's immediate interests; were composed for the momentary service; they assumed no regular form; and possessed few of the requisites to a complete and accurate body of laws. These fragments, as we have before stated, were, by the succeeding caliphs, collected into one volume, in the form of the present Koran.

The whole is divided into one hundred and fourteen portions, which may properly be termed *chapters;* and these again into smaller divisions, which may with equal propriety be called *verses*.

There is not the slightest approximation to any thing like design or method in either the larger or the smaller divisions. Neither the time at which they were revealed, nor the matter they contain, was the rule by which they were arranged; they were, in fact, thrown together without order or meaning. The divisions of the chapters also are equally faulty. One verse has seldom any connexion with the preceding; and the same subject is in no case continued for a dozen verses in succession: each one appears an isolated precept or exclamation; the tendency of which it is difficult, the pertinence impossible, to discover.

The first nine titles will convey to the reader a fair conception of the skill in arrangement and nomenclature manifested by the prophet's followers.

1. The Preface. 2. The Cow. 3. The Family of Iram. 4. Women. 5. Table. 6. Cattle. 7. Al Araf. 8. The Spoils. 9. The Declaration of Immunity.

The language of the book, if we may judge by the translations we possess, is by no means superior to its arrangement. The Arabians themselves declare it to be beyond competition. Nothing inferior to the divinity, say they, could have composed such magnificent sentences. Mahomet himself was so convinced of the beauty of his style, that he boldly advanced its perfection as the most striking proof of the authenticity of his mission. "The Koranists, or persons attached to the Koran, find nothing eloquent or excellent out of the Book. They assert that Lebid, one of the most famous poets of the Arabs, became a convert upon the reading of three or four verses of the second chapter, which he believed inimitable in their style. These Koranists are great enemies to the philosophers, par-

* D'Herbelot, Bib. Orient. mot FEK.

ticularly to metaphysicians and schoolmen. They condemn both Averroës and Avicenna, the two greatest ornaments of Moslemism; and also Plato and Aristotle*." We suspect, however, that the Arabians are as ignorant of style as of method. Rhapsody is in no place less desirable than in a body of laws. The expression of a law should be precise, clear, complete, and brief. It would be difficult to discover any of these qualities in any portion of the Koran. To an Arabian ear the language may probably possess beauties that none but an Arabian can feel. But these delicate graces of style, though, in poetry, of infinite importance, are of secondary, perhaps, no importance whatever in a book of laws. It is more than probable, also, that even these graces are exaggerated, and that fashion makes an Arabian pretend to feel beauties which in reality he never discovered.

RELIGION.

One thing it will be necessary to premise respecting the standard to which we intend to refer the religion of the impostor. The religion of Mahomet, unfortunately for the largest portion of the human race, was not the TRUE RELIGION. As a means of salvation, therefore, it is worse than useless: we know too well that it cannot save men hereafter, we need only inquire if it can possibly make them happier in this life.

On examining the precepts of the Koran, we are astonished how little was either added to or altered by Mahomet in the ancient belief and institutions of the Arabs; and, moreover, we cannot but feel sensible that these alterations and additions were scarcely, if at all, for the better. The religion of Mahomet, as contra-distinguished from that of his countrymen, was marked by three peculiarities: the first was, that he established the worship of a single God; the next, that he set himself up for his inspired minister; the third, that he commanded his followers to propagate their belief by the sword. The first of these, viewed in conjunction with his other doctrines, was little more than a nominal improvement, the two last evidently mischievous.

The wild Indian, who, in the sun, fancies he beholds the sole governor of the universe, and to him alone pays his adoration, believes evidently in a single god; but no one can say that he believes in the only true God. His god is a phantasy, and may be a terrible phantasy. The ignorant savage may fancy him a being endowed, not with mild and merciful, but malignant and revengeful qualities. If to this savage there should come some eloquent but half-instructed philanthropist, who should teach him that, instead of one such terrible Divinity, there were two, whose pleasure was creating happiness not misery; who, in their beneficent solicitude, fashioned this wonderful universe, in order to enjoy the spectacle of a world of happy creatures; can we believe that the religion of the savage would not be improved, though now he should offer up his orisons to two divinities instead of one? Mahomet, in circumscribing the number of the Arabian gods, altered not their character. He left them as he found them —easily irritated, with difficulty appeased; revengeful and capricious; to be propitiated rather by ceremonies than by virtuous actions; more interested in the proper cut of a votary's nails, or in the regular prostrations of his body, than in the happiness he enjoyed himself, or in the conduct he pursued towards others. There were seven things in which the faithful Mussulman was to believe; four things which he was to perform, only one of which was connected with the temporal welfare of himself or his fellows.

1. He was to believe in Mahomet's God; 2. in Mahomet as his prophet; 3. in his angels; 4. in his scriptures; 5. in his prophets; 6. in the resurrection and day of judgment; 7. in God's absolute decree and predetermination of good and evil.

His imposed performances were—1. Prayer, under which were comprehended the washings and purifications; 2. Alms; 3. Fastings; and, 4. Pilgrimages to Mecca*.

"There is no circumstance connected with a religious system more worthy of attention than its morality —than the ideas which it inculcates respecting merit and demerit; purity and impurity, innocence and guilt. If those qualities which render a man amiable, respectable, and useful as a human being; if wisdom, beneficence, self-command, are celebrated as the

* D'Herbelot, mot ALCORAN, p. 81.

* Sale, Pre. Disc. sec. 4, p. 93.

chief recommendations to the favour of the Almighty; if the production of happiness is steadily and consistently represented as the most acceptable worship of the Creator, no other proof is requisite, that they who framed, and they who understand this religion, have arrived at high and refined notions of an all-perfect Being*." Taking this observation for our standard, it requires little penetration to discover that the conceptions of Mahomet respecting the requisites for a perfect religion, were those of an ignorant barbarian. Throughout the Koran, the greatest possible stress is laid upon the necessity of a belief in Mahomet's pretended mission; all other virtues are useless if this single point of the prophet's divine appointment be not steadily fixed in the mind, and constantly present to the imagination of the aspirant to everlasting life. But while belief in the pretended prophet is thus exalted to the highest point the imagination can conceive, the really useful qualities are placed low down in the scale of importance. The consequence is, that the votary is careless of his conduct so long as he is fortunate enough to preserve a belief of the proper description. The faithful, that is the believing, Mussulman is in no doubt concerning his reception into the heavenly regions, if, while in the minor consideration of virtuous conduct, he might be wanting, he should have strictly followed the ceremonious observances of his religion, and firmly believed in the impostures of his prophet. This assertion is amply borne out by experience. A Mussulman proverb condemns every man as untrustworthy who has performed the pilgrimage to Mecca.

That general precepts may be found in the Koran, which, in emphatic language, command men to be virtuous, cannot be denied; but it must be remembered that no legislator ever deliberately, in words, recommended vice. A general command to be virtuous is of little service, and should by no means receive our approbation till we have learned what, in the legislator's opinion, is deemed to be virtuous. The great object of every legislator is to enforce the observance of what he commands; that observance *he* would consider virtue, though he should command his subjects to slay all who wore clothes or professed opinions differing from their own. These vague and general precepts, then, may be considered as neither beneficial nor otherwise: no matter how emphatic, how beautiful may be the language in which they are conveyed. The circumstance really important is the *conduct* which the legislator has enjoined, and to which he has attached the character of virtue. We must learn what acts the legislator considers most acceptable to the Divinity; what acts he recommends to the approbation of mankind. We again quote Mr. Mill.

"If we search a little further, we shall discover, that nations do not differ so much from one another in regard to a knowledge of morality and its obligations (the rules of morality having been taught among nations in a manner remarkably similar), as in the various degrees of steadiness, or the contrary, with which they assign the preference to moral above other acts. Among rude nations it has almost always been found that religion has served to degrade morality by advancing to the place of greatest honour those external performances, or those mental exercises, which more immediately regard the Deity; and with which, of course, he was supposed to be more peculiarly delighted. On no occasion, indeed, has religion obliterated the impressions of morality, of which the rules are the fundamental laws of human society. It has everywhere met with the highest applause, and no where has it been celebrated in more pompous strains than in places where the most contemptible, or the most abominable rites have most effectually been allowed to usurp its honours. It is not so much, therefore, by the mere words in which morality is mentioned, that we are to judge of the mental perfection of different nations, as by the place which it clearly holds in the established scale of meritorious acts *."

From the list of actions we have given, as necessary to a perfect Mussulman, it is obvious that Mahomet established a scale of meritorious acts, in which idle, ridiculous, useless, and sometimes mischievous observances occupy the chief place, while all really useful actions are passed over as unimportant. We need no further proof of the low character both of his religion and his morality.

* Mill's Hist. of British India, b. 2. c. 6. p. 263.

* Hist. of Brit. India, b. ii., c. 6, pp. 278, 279.

One mischievous portion of his religion must not be forgotten, viz., the command to propagate it by force*. If there be one means more effectual than another of keeping men in perpetual ignorance, and consequent misery, it is to make truth and justice always the portion of the strongest. If, to the settlement of contending opinions, force alone be necessary, it is evident that the correctness of either is a matter of no moment. Consequently to discover whether an opinion be founded in truth will never be the aim of the disputant. The measurement of his own and his adversary's powers, is the circumstance that will concern him; he will be careless concerning the propriety of his belief, so long as his arm is the stronger; and hatred the most violent will arise in his mind against all who do not agree with him, inasmuch as non-accordance with his opinion implies a contempt of his power. He will learn to attach to words and symbols immeasurable importance, for they will be all that he can understand. His mind will be shut against conviction; and turned with implacable animosity against every one who hoists not his standard, or who is not attached to his formula. Every bad passion will be generated in his mind; irascible, impatient of contradiction, and revengeful, he will be ignorant himself, and determined to keep others so; will resist every improvement, as an attack upon his creed, and invariably weigh every man's worth, not by his actions, but by the words of his belief.

The Arabians, before the appearance of Mahomet, were a tolerant people. They forced none to believe as they believed; but lived in harmony and friendship with persons of every persuasion. In the retired cities of Arabia, the Christian, the Jew, and the Pagan, all found a refuge; and not till the persecuting spirit of Islam was established, were they disturbed in their hitherto peaceful abode. Arabia, however, became through Mahomet divided against itself; and to the many already existing causes of dispute were added the direful animosities of religion.

* The following saying of Ali raises a vivid conception of the success of Mahomet's preaching on this head: "Holy wars are the pillars of religion, and the highways of the happy; and to them who are engaged in them, the gates of heaven shall be open."—(Ockley's Trans. of Ali's Sayings, cxxxi.)

### LAW.

Nothing but the prejudices of education could make a reasonable man look upon the Koran as a book of jurisprudence capable of conveying instruction to any but a nation of savages. Deficient in form; deficient in clearness; incomplete, it possesses not one single quality requisite to a body of law. In the midst of a vast farrago of nonsense, hidden amidst unmeaning explanations, and dark mysterious prophecies, there sometimes appears a command respecting the distribution of property, or the punishment of offenders. But no explanations are given—no regular description of the means by which property may be acquired; no enumeration of those by which the rights to it may be lost, is even attempted. The rights of individuals, in their several capacities, to the services of others, are nowhere distinctly mentioned; nor is there any the most distant approximation to a systematic view of the several obligations to which it was intended to subject the members of the community. As occasion prompted, or when a dispute happened, Mahomet was accustomed to issue a revelation, which answered for the immediate purpose. But the original unwritten customs of the Arabs remained in full force, receiving little modification from the decrees of the prophet. One advantage, and one alone, he may be supposed to have originated,—his were *written* decrees; it was a commencement for a body of laws, though a rude and imperfect one. This benefit, however, is more than counterbalanced by the evil of their being irrevocable. What the ignorant barbarian instituted, succeeding generations have been obliged to retain. No matter how absurd, how injurious the decree, religion commands the faithful Moslem to abide by it. The Almighty was its author, and he is all-wise; and, moreover, is as wise at one time as another. How, then, shall we pretend to amend the divine ordination, or fancy that he himself need amend it? The conclusion is irresistible, provided the premises be allowed. The nations who have assumed the Moslem faith have consequently remained, and, while professing it, will remain, barbarians.

Into the particular laws which Mahomet established we do not intend to examine. That many of them were useful cannot be denied; but to esta-

blish them argued no great wisdom on his part, whilst the loose and uncertain manner in which they were promulgated shows that he himself attached little importance to their establishment. Succeeding ages have, in some degree, improved upon this rude system of law; but the improvement has been effected by the increasing civilization of the people, which has advanced in spite, not in consequence, of the Koran. As the opinions of the people have become more enlightened, better interpretations have been put upon the sacred volume; it has thus, in appearance, kept pace with the improvement of the people. From the obscure style in which the holy book is written, it is liable to several interpretations; in a barbarous age, a barbarous interpretation was the one chosen; but when succeeding times revolted at these abominable precepts, the interested clergy declared that their predecessors had been mistaken; that the true spirit of the Islam religion and law had been misunderstood. It has nevertheless constantly, and for the most part successfully, withstood all improvement. The amelioration in its tenets has been rare; and has never taken place till the bigoted priesthood foresaw that further opposition would be dangerous.

Even from this hasty and imperfect review of Mahomet's actions as a legislator, the reader will be able to form a tolerably correct estimate of his public character. That he was a barbarian, unskilled in the sciences of which he professed himself the inspired teacher, and deserving a very small portion of applause, as having advanced the civilization of his people beyond the point at which he found it, is abundantly manifest: that he was superior to the age in which he lived may be believed from the success of his imposture. Among a people so rude as the Arabs, however, a very slight superiority was sufficient to render him thus successful. His talents contributed to his own fortune, not to his nation's improvement; he was skilled in whatever was necessary for his personal aggrandisement; in whatever was useful to others he was miserably deficient.

Of his private character we need say little. He has usually been branded with opprobrium for not conforming to established rules of morality, of which unhappily he was totally ignorant. For this, assuredly, he deserved no reprehension. That, however, for which he does deserve the severest reprehension, is his departure from the morality which he approved and adopted. The moral code of a people must be judged by its approximation to that perfect standard which provides completely for the happiness of mankind; but the moral character of a particular man must be judged by the steadiness of his adherence to that code which he considers the correct one.

His unbounded gratification of his amorous propensities has been urged as a proof of his immorality. In this, however, he followed the manners of his countrymen: among them it was no crime to maintain as many female slaves and wives as their wealth permitted, and their desires prompted. Mahomet, in acting up to the measure both of one and the other, offended against no rule of morality with which he was acquainted.

Mahomet was a murderer and an impostor. He prompted and approved of the assassination of Sophyân and Caab. It must, however, be recollected that, among the barbarous Arabians, the same carefulness of life was not inculcated as among a civilized people; and the prophet, in getting rid of his enemies, did not outrage the feelings of his friends or his enemies. We cannot, indeed, but detest the morality of a people who tolerated such conduct, and also hold in exceedingly low estimation the civilization of him, who, pretending to improve that morality, upheld and practised the very worst portion of its tenets.

That Mahomet was an impostor cannot be doubted. In the early part of his public life he might have fancied himself somewhat peculiarly gifted; but that his self-delusion should have continued to the later years of his life, to such an extent as to acquit him of fraud, is utterly impossible. His story of the heavenly journey was a fiction, which nothing but absolute madness could have permitted him to believe. Moreover, the constant visits of the angel Gabriel, precisely at the critical moment when his aid was needed, are sufficient evidence of a perfect absence of all self-delusion. But, being an impostor, did he employ the power he acquired to the advantage of his people or to his own aggrandisement? He exalted himself

to a throne, and, possibly, when his own interests were not concerned, did, as far as his abilities enabled him, further the welfare of his people. He was not cruel, nor sanguinary: his conquests were generally speaking marked by no butchery*; nor was his government a tyrannical one. In his private life he was mild and gentle; affectionate to his friends and his wives; and just and honourable in his dealings. As a private man, among his own people, he was esteemed virtuous and beneficent. For the most part he wanted rather the knowledge than the will to be an estimable citizen, as well as a beneficent legislator. His vices were the vices of his age; and, as he was little superior in knowledge to the men by whom he was surrounded, it is not wonderful that he did not greatly surpass them in virtue.

* Like other conquerors, Mahomet was occasionally cruel: he was, nevertheless, as compared with his age and nation, a merciful conqueror.—See, for specimens of his cruelties, Mod. Univ. Hist. b. 1. c. 1. p. 131.

## NOTE.

It may be of service to point out to the reader the authorities on this portion of history. In reading to acquire knowledge respecting the fortunes of mankind during any particular period, two objects should be kept in view:—1*st*, to discover what events occurred; 2*d*, to learn the manners and institutions of the people whose history we are investigating. A detail of events without a knowledge of the institutions and customs which must materially have influenced those events, is utterly barren of instruction. Under this twofold division we shall therefore class the authors which we are about to recommend. It must be remembered that only such portions of history are here in contemplation, as are requisite to elucidate the life of Mahomet.

### I. *Works giving the History of Events.*

1. The first we should recommend is the first chapter of the first book of the Modern Universal History, which as a repertory of facts is valuable. The Arabic scholar could not do better than trace out the Arabian authors there quoted.

2. Chapters 50 and 51 of Gibbon's Decline and Fall. These contain an easy, graceful narrative of the prophet's life and the comments of his followers, a superficial account of his institutions, and a host of authorities to which the industrious historical reader would do well to refer. In Gibbon, moreover, will be found a clear description of the situation of the Greek empire, and all we know on the subject of Persia during that period.

3. Gagnier's Life of Mahomet contains the fullest account of his fortunes that any writer has left us. Gagnier has written precisely as a Mussulman might have written. He has related all the wonderful stories that the Arabs report of their prophet; and coolly describes every act of atrocity without observation or repugnance.

4. Prideaux will add little to our knowledge, but his book is not long.

5. Ockley's History of the Saracens. A most remarkable and original work, giving a lively picture of the times; containing some good, and many extravagant observations: it well deserves perusal.

6. Pocock's translations will be read by a hardy and determined investigator, but by no other.

These sources will be sufficient; and if more be required, the reader will be able, from the light they afford, to discover the remainder for himself.

### II. *Works respecting the Manners, Institutions, &c.*

1. Sale's Koran, and Preliminary Discourse. It would be difficult to find a more excellent authority. He has few prejudices, and relates a great deal. The reader is presented with a copious and candid detail, and is generally left to form his own judgment. Like too many other oriental scholars, however, Sale was much inclined to overrate the worth of that literature of which he enjoyed a sort of monopoly. His facts may be relied on.

2. Ancient Universal History, vol. xviii. b. iv. c. 21, written by Sale, and containing an excellent account of the laws and customs of the Arabs.

3. Niebuhr's Travels. The best of oriental travellers: he relates honestly, and judges like a philosopher.

4. D'Herbelot. Bibliot. Orientale. Of this work, Gibbon says, "the *Oriental Library* of a Frenchman would instruct the most learned Mufti of the east;" and again, "for the character of the respectable author consult his friend Thevenot (Voyages du Levant, part i. c. 1.) His work is an agreeable miscellany, which must gratify every taste; but I can never digest the alphabetical order, and I find him more satisfactory in the Persian than the Arabic history." (Decline and Fall, c. 51.)

5. Not connected immediately with the present portion of history, but an admirable guide nevertheless in our investigations, is Mill's British India, b. 2. The author of the present work cannot omit this opportunity to acknowledge the great debt he owes to the profound historian of British India.

6. The French writers of the eighteenth century, more particularly of the Encyclopédie, are unsafe guides. Their conclusions are generally well drawn from false data. So with Voltaire.

7. Of the various modern travels into Arabia it is not necessary to speak specifically. They are all amusing, and many of them instructive. Their facts generally can be relied on.

# LIFE OF CARSTEN NIEBUHR.

*Introduction.*

The memoir which we are about to lay before our readers is the life of a man sprung from the ranks of the people, and retaining through life his sympathies with them. At the highest point of elevation to which he attained, favoured by his prince, respected and admired by the learned and eminent of all countries, it was his pride that he was born a peasant of Free Friesland. His manners never lost the simplicity, nor his morals the purity of that singular and estimable class of men. If ever there lived a man who might safely and reasonably be held up to the people as an object of imitation, it was Carsten Niebuhr.—Not only was he a poor man,—an orphan,—born in a remote part of a remote province, far from all those facilities for acquiring knowledge, which in this age and country are poured out before the feet of the people;—he was not even gifted in any extraordinary way by nature. He was in no sense of the word a *genius*. He had, as his eminent biographer remarks, no imagination;—his power of acquiring does not seem to have been extraordinarily rapid, nor his memory singularly retentive. In all cases where the force of that will, at once steady and ardent, which enabled him to master his favourite studies, was not brought to bear, his progress was slow and inconsiderable. It is not, therefore, in any supposed intellectual advantages that we must look for the causes of his rise to eminence. They are to be found rather in the moral qualities which distinguished him, qualities attainable in a greater or less degree by men of the humblest rank, of the most homely intellect, the least favoured by situation or connexion. It will well repay us to look a little more nearly into these qualities;—they are the bases of everything which a man of unperverted judgment and taste would respect in others or desire in himself.

He possessed in an eminent degree the distinguishing virtues of his country,—sincerity, unadulterated and faithful love of truth, and honesty. The zeal with which he gave himself to a pursuit which might enable him to be useful to his native district;—the total absence of vanity and of all interested motives which characterized the whole course of his studies and of his journeyings;—the simplicity of his narrative, in which no more of himself and his individual feelings appears than is just necessary to keep up the thread of the story;—the rigorous accuracy and anxiety after truth for which his travels have ever been, and still remain, pre-eminently distinguished among all who preceded, and all who have followed him on the same ground, afford ample evidence of the singleness and the steadiness of the motives which actuated him. The punctilious honour which distinguished his disbursement of the funds entrusted to his care by the Danish government;—the exactness with which he abstained from applying a farthing of this money to any object which could be considered by others, or which his own more fastidious delicacy could regard, as a personal gratification, (though connected as all his pleasures were with the interests of science and the scope of his mission, prove that honour is confined to no class, but that its highest refinements are within the reach of the humblest.

His self-command was perfect. He could abstain from what was agreeable, and do what was disagreeable to him. He was, of course, sober, temperate even to abstemiousness, laborious and persevering; neither discouraged nor elated by the incidents which he must have known were inseparable from the career he had chosen.

The more tranquil and uniform course of life which he led from the time of his marriage till his death,—his conduct as a father of a family and a citizen, are marked by the same integrity, active usefulness, and simplicity. It was not one of the smallest benefits he conferred

upon his country and society that he imbued his illustrious son with the same fervent and steady zeal for truth and freedom, the same devotion to science, the same respect for all that is beneficent and honourable, which animated his own blameless and useful life. Happy the country which can draw such men as Niebuhr from the ranks of her peasantry to the highest walks of science, and the most important posts in her service!

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## Life of Niebuhr.

Hadeln, as we are informed by the historical notice at the end of the ancient Frisian laws, printed at Wittewierum, was a province of Friesland, and formerly, under the name of Hadelre, belonged to the seventh *Seeland**, or maritime district. At the dissolution of the great Frisian federation, it lost its republican freedom, and, after experiencing various fortunes, fell into the hands of the Dukes of Saxelauenburg, and, together with that duchy, devolved to Hanover.

The country consists of marsh, with the exception of three parishes of moorland: the peasantry are, as usual in Friesland, universally free proprietors, every one of whom possesses, inhabits, and cultivates his farm, with the fullest and most perfect enjoyment of the rights of property. Down to the time of the French conquest the local administration was free, in the hands of magistrates chosen by the peasantry;—the taxes were extremely light, and the prosperity and comfort of the peasantry very great†.

In this country,—among these free men,—himself a free peasant, or yeoman,—was Carsten Niebuhr born, on the 17th of March, 1733, in his father's farm-house, in West Lüdingworth. His father and his ancestors, from his great great grandfather) downwards, (higher than whom our accounts do not reach) lived as yeomen on their own marsh farm;—in competence, though not in affluence.

It is a remarkable fact that certain epochs produce men distinguished in the same art, or science, or talent, whilst other epochs are utterly barren of them. This was the case, in the north of Germany, with the contemporaries of Carsten Niebuhr. In or about the same year occurred the births of Count Andrew Peter Bernstorf, of Reimarus, Hensler the father, Behrens, and, at remoter distances of time and place, of many other celebrated men. The men of this time were distinguished for a remarkable activity, a singular earnestness and zeal, and a robust health of body and of mind; they have left behind them the most durable monuments in their works and in their actions. They came after Winkelmann, Kant, and Klopstock, by just such an interval as to be rising up to maturity when the latter had reached it.

Carsten Niebuhr lost his mother before he was six weeks old. He grew up under the care of a stepmother in his father's house, where his way of life and his employments, as well as his education, were those common to the peasant boys of his country. It was, probably, owing to his own eager desire for knowledge, that his father was induced, only with a view to his being somewhat better instructed than a common peasant, to send him to the Grammar-school in Otterndorf, whence he afterwards went to that at Altenbruch. But the removal of the schoolmaster of that place and the prejudices of his guardians (for his father had died in the interval) put an end to his school studies, before he had gone far enough even to have them sufficiently impressed on his memory, to be of any service to him, when he afterwards resumed them.

The division of his father's property between the surviving children had left him, instead of the farm which had been so long the hereditary possession of the family, only a very small capital,

* Friesland, divided into seven Seclanden, or provinces, was exposed to frequent landings of the Normen on their coasts, and on the landside to attacks from the neighbouring Bishops and Counts. To secure themselves from external assault and from internal disquiet, the seven Seclanden formed themselves into a closely united body. This union was ratified at Upstalsboom in the middle of the 11th century, at a general assembly of the people.—Wiarda.

† The peasantry of Friesland enjoy many remarkable rights and liberties rarely to be found in other countries. At one time the *Landstandschaft*, or right and dignity of legislative landed proprietors, was claimed by the freeholders or hereditary owners of small portions of land. These freeholders are chiefly to be found in the marshes, and the marshmen are principally distinguished from the moorlanders from the rareness of allodial tenures among them. The freeholders possess the entire property of their land, and are subject to no one but the government, to which alone they pay taxes and render the service attached to the land. Those freemen who possess not considerable farms, but a few acres, are called Cotters (Köther) and generally carry on some other accessary or subordinate business.—Wiarda.

quite inadequate to the purchase of any land for himself; and necessity would have led him to acquire knowledge as a means of subsistence, even if he had been of a character to endure to live without education and without employment. He was obliged, however, to content himself with such accomplishments as were attainable without school learning; he, therefore, for a year, pursued music with great zeal, and learned to play on several instruments with a view to earn his living as an organist. As this employment, likewise, did not meet the approbation of his guardians, his maternal uncle took him home to his own house, where he passed about four years, during which his life was once more completely that of a peasant. The older he grew, however, the less could he endure the void and dulness of this way of life, which can only be relieved, either, as in old times, by a share in the general deliberations on the affairs of the community, and by cheerfulness and merriment, or, as is the case with the English farmer, by a participation in the advantages of education, and literary amusement. He felt an irresistible impulse to learn, to employ himself, and to render himself generally useful.

The purely accidental circumstances which determine the course of life of distinguished men deserve to be remembered. In the highest degree accidental was that which gave to Niebuhr the direction which he thenceforward followed, until it led him to become the most eminent traveller of modern times. A lawsuit had arisen concerning the superficial contents of a farm, which could only be decided by measurement; and, as there was no landsurveyor in Hadeln, the parties were obliged to send for one to another place. Niebuhr felt for the honour of his native district with all the warmth of old times, and this occurrence appeared to him disgraceful to it: he could now fulfil a duty towards his country by learning the neglected art, which at the same time furnished him with an occupation and an object such as he desired. He was, in the meantime, come of age, and, as he learnt that instruction in practical geometry was to be had in Bremen, he immediately repaired thither. This plan was frustrated; the teacher upon whom he reckoned was dead; but he did not disdain the instructions of a humble practitioner of the art. He, however, would have been obliged to lodge and board in his house, and here the bashful, strictly decorous and self-distrusting young peasant, found two town-bred young ladies, sisters of his intended teacher, whose attentions appeared to him so singular that he quickly took his departure. He now turned his eyes toward Hamburgh, but there he was destined again to experience disappointment, and to have his perseverance put to the test.

He had passed his two-and-twentieth year when he went to Hamburgh to avail himself of Succow's instructions in mathematics, and, without any false shame on account of his age, to begin his school studies anew. His income was not sufficient to maintain him even with that rigid frugality which was natural to him. He determined, however, to spend just so much of his small capital as would enable him to accomplish his end. He arrived at Hamburgh in the summer of the year, 1755, as we find from his letters to president Beymgraben, the only friend of riper age and judgment he then possessed, by whose family they are reverentially preserved.

But just at this time Succow was called to Jena: the mathematical chair was empty, and was not filled until Büsch was appointed to it. The severest application to private instruction was, therefore, necessary to make the lessons at the gymnasium (or public school) intelligible or profitable to him. A countryman of his, named Witke, who, at that time, lived in Hamburgh as candidate for holy orders, and who afterwards died at Otterndorf, where he was pastor, gave him this private instruction with true cordiality and friendship. Niebuhr always spoke of him as the person who laid the foundation of his education, and, as such, honoured and loved him with grateful piety. Notwithstanding his uncommon exertions, and the strength both of his body and mind, twenty months, eight of which passed in merely preparatory studies, (for the Latin tongue was almost entirely unknown to him,) were quite insufficient for one who began to learn so late in life; to acquire that quantity of learning which more fortunate youths bring with them to the university. Among other things thus unavoidably neglected was Greek, which he always greatly lamented the want of.

Under Büsch he had begun to learn mathematics: he was the earliest and

solely for his object. He pursued his studies in pure mathematics, perfected himself in drawing, and sought to acquire such historical information as was attainable with that degree of learning which he had so lately and so imperfectly acquired, without neglecting his more immediate objects. He cultivated practical mechanics with a view to acquiring greater dexterity in handling his instruments, and in various manual operations, the acquirement and practice of which in Europe, except for those whose business they are, is but a waste of time. His attention was, however, principally occupied by the private lessons of Michaelis in the Arabic language, and of Mayer in astronomy. These he remembered with very different feelings. For the grammatical study of languages in general he had but little talent or inclination; but his lessons in Arabic were rendered peculiarly distasteful to him by the fact that, at the end of several months, his teacher had not brought him farther than the first fables of Lokmann, and he soon found out that Michaelis possessed no very great store of Arabic philology or learning. He therefore gave up this course of instruction, which Michaelis never forgave him.

Tobias Mayer was undoubtedly one of the first astronomers and mathematicians of his time*. Mayer's zeal for teaching his pupil was as great as Niebuhr's for learning of him. Among all the men with whom he became acquainted in the course of his long life, there was none whom he so loved and honoured as Mayer; and the most intimate friendship subsisted between them. He retained an ardent attachment to Mayer's memory up to the most advanced age, and fate never procured him any pleasure so great, as that of hearing that his first lunar observations reached his beloved teacher on his death-bed, before consciousness had left him, and had cheered and animated his last moments; and that these observations had decided the giving the English premium offered for the discovery of the longitude, to the widow of the man to whom he felt that he was indebted for his acquirements in this branch of science. Mayer on his part had no more earnest solicitude than to educate a pupil who would apply his method of determining the longitude, and his, at that time, unprinted lunar tables, of which Niebuhr made a copy.

He probably saw that blind, mechanical attachment to old ways and prejudices would for many years retard the reception of his method, but that, when proved by practical application, it would be impossible to stifle it. Mayer interested himself in the outfit for Niebuhr's journey, so entirely as if it had been his own personal affair, that he divided his quadrants with his own hands. The accuracy of this labour of friendship was proved by the observations which were made with it.

The time appointed for preparation had been prolonged by half a year; and it was not till the Michaelmas of 1760 that he left Göttingen. At Copenhagen he was most kindly received by the minister von Bernstorf, and gained his confidence to a greater degree than the other members of the expedition, who were already assembled there before him. As he received a pension from the king during the time of his preparation, he thought himself bound to purchase all his instruments at his own cost. He esteemed himself most happy to procure them in this manner. Bernstorf, to whose knowledge this accidentally came, pressed upon him compensation for what he had thus expended, and committed the travelling chest to him as a proof of respect for his rigid integrity.

He was at this time appointed lieutenant of engineers, a circumstance which only deserves notice for the sake of a letter which places his modesty and judgment in the most amiable light. "He was," as he wrote to a friend, "led to think of a title [for himself by Von Haven's appointment to a professorship of the university of Copenhagen. A similar one had been offered to him, but he held himself unworthy of it. The one he had received appeared to him more suitable. He might have had that of captain if he had asked for it; but that, for a young man, would have been too much. As lieutenant, it would be highly creditable to him to make valuable observations; but, as professor, he should feel it dis-

* The results of his labours were published after his death. They consisted principally of a catalogue of 992 stars, and his famous lunar and solar tables. His valuable theory of the moon, and the laborious calculation of these tables, together with the invention of Hadley's quadrant, in 1731, enabled Maskelyne to bring into general use the method of discovering the longitude by observing the distance of the moon from the sun and certain fixed stars, called the lunar method. Mayer died at the early age of thirty-nine, worn out and exhausted by his incessant exertions in the cause of science.

graceful not to have sufficiently explored the depths of mathematical science." He had at that time no other plan than that of living in his native country, after the accomplishment of his mission, on the pension which was assigned to him.

As more than half a century has elapsed since the death of his travelling companions, there can be no impropriety in recording what he thought and related of them.

Von Haven's uselessness as a linguist has already been mentioned. He had moreover chosen a career, for which, on all accounts, no man was less fitted. His sole thought was to return home; his favourite topic was the comfortable life which he there promised himself: no ardour for discovery or for observation made him forget the fatigues and privations of the journey, and no one had so many wants, and felt so many privations, as he. A dainty table and good wine were, in his estimation, the greatest blessings of life; and in Arabia, where the travellers found only scanty fare and bad water to appease their hunger and thirst, his discontent arose to a despair which often diverted, but sometimes disgusted his companions. He was by nature indolent, and thought himself fully excused from working under such a climate. He likewise frequently shewed himself haughty and conceited towards Forskaal and Niebuhr; he behaved as if he thought himself the highest and most distinguished of the party; and was greatly offended that Niebuhr had the care of the chest. After his death nothing of the slightest utility was found in his meagre journal.

According to Niebuhr's judgment and testimony, Forskaal was by far the most instructed of the party, and had he returned, would have attained to the highest rank among the contemporary men of science, by his manifold and profound acquirements. He had originally studied theology; his eager and free spirit had led him from Sweden to Germany; for a long time he had devoted himself to speculative metaphysics with great ardour; he likewise pursued the study of eastern languages, and at the same time as much of physics and chemistry, as well as of every branch of natural science, as was then known. The metaphysics of a mind of this stamp must have been very different from the scholastic pedantry of the time: the academical works in which he published his speculations on these subjects passed at Göttingen for odd—in Sweden, for rather bold and flippant; it is matter of regret that we do not know them. He willingly quitted his country, where, after his return from the university, he met with hostility on every side.

He stood in need of no preparation; the proposal for the journey found him perfectly prepared, and that to a degree in which few ever become so. In laborious industry, contempt of dangers, difficulties, and privations, he resembled Niebuhr. Both felt themselves called upon to observe whatever came before them. Forskaal's learned education, however, gave him a great advantage. He acquired languages much more rapidly and perfectly, and was soon able to read Arabic works with fluency. His faults were disputatiousness, caprice, and an irascible temper. Mutual respect and equal zeal produced a stable friendship between Niebuhr and him; but the harmony between them was not without some interruptions, until Forskaal on one occasion discovered that his companion's patience was not completely inexhaustible and impassive. Forskaal's papers have been carefully used by his friend, and what they contained of a narrative kind, or illustrative of the manners of the people, is inserted in Niebuhr's works with the author's name. Of the edition of his works on natural history we shall shortly have occasion to speak. It is painful to see how they have been neglected. Besides the systematical descriptions of new plants and their uses, they are rich in admirable observations on vegetable physiology, and in remarks on the husbandry and geological structure of the countries he traversed, particularly of Egypt, of which no such description previously existed. The late Vahl preserved and restored Forskaal's neglected herbarium, so far as it was still possible, and laboured to do justice to his memory. Linnæus manifested an odious spirit of hostility to his old pupil. Forskaal had told Niebuhr that he wished one of the species of plants he discovered (the one called Mimosella, in his Flora) to be named after himself. Niebuhr transmitted this wish of a man who had deserved immortality by his labours, to Linnæus; but instead of paying any attention to it, he gave Forskaal's name to another species, also discovered by him, but which conveyed, by its appellation,

the most obvious and malicious allusion to the departed. Niebuhr could never forgive this spiteful trick. Forskaal had also called one species of plants after him, in remembrance, perhaps, of the cordiality with which Niebuhr had assisted in all his excursions and collections. This, however, as he was no botanist, appeared to him inappropriate, and the sole alteration he permitted himself to make in Forskaal's papers, was to erase every trace of the honour intended him.

Of the physician, Dr. Cramer, nothing is to be said, except that the choice of him was most unfortunate; that he was incompetent, even in a professional point of view, but still more so for all the purposes of the expedition. It is to be lamented that Michaelis's wish to engage Hensler the father for the situation was fruitless. The draughtsman, Bauernfeind, was not a bad artist, but an uneducated and extremely narrow-minded man: love of drinking shortened his life.

The journey began under the most unfavourable auspices. The party went on board the Greenland ship of war which was bound to the Mediterranean to protect vessels sailing under Danish colours from English search. The Greenland left the Sound on the 7th January, 1761. Three times she was driven back to the Elsineur roads; nor was it till the 10th of March, the fourth time of her sailing, that she could continue her course to the Mediterranean.

Niebuhr recollected this voyage with pleasure. The noble and beautiful interior of a ship of war, with all its appointments and regulations, the simple and energetic manliness of the sailors, from the commander to the lowest man on board, a class of men whose distinguishing virtues were very much allied to his own, interested and delighted him in the highest degree. Nor did he find the way of life monotonous or dull. Navigation was, at that time, very imperfectly understood: its operations were conducted in a manner rather mechanical than scientific. The officers of a ship going on such a service were, however, doubtless, men distinguished in their profession. Niebuhr endeavoured to make himself acquainted with the construction of the ship; and he exercised himself daily in nautical and astronomical observations which procured him the satisfaction of being regarded by the officers as an active and useful member of their company. He thus obtained from them that respect and regard which practical men are always ready to bestow on those whom they find to be superior to themselves on any particular subject connected with their own business, and whom they see willing to acknowledge their superiority in other points, and able to appreciate their merits and services*.

Mayer, in the instructions he gave Niebuhr, had constantly kept in view that his pupil would be placed in situations in which it would be absolutely necessary for him to be able to rely upon himself, and where he could not hope for the slightest assistance or support. He had taught him entirely himself, and encouraged him with the assurance that an active and clear-sighted man is generally able to discover means of overcoming the obstacles which may oppose him. His method of teaching, which was entirely practical, was chiefly this. He first described to his pupil the object of the observation and the method of using the instruments: he then left him without any assistance, to try how far he could proceed in his observation and calculation, and desired him to tell him when he came to any insurmountable difficulty. He was obliged to describe exactly how far he had gone on well, and where his progress had been stopped; and then Mayer helped him out. He had been able to exercise himself but little in Göttingen in calculating lunar distances, and was in great anxiety about his future success in that point. The result of his observations during this voyage gave him greater confidence, and ought to have convinced him that he had gone through his apprenticeship, but this his modesty and humility forbade.

A stay of some weeks at Marseilles, and of a shorter time at Malta, procured a very agreeable recreation to the party. The scientific enterprise was known throughout Europe, and we should find it difficult, now, to picture to ourselves the universal interest in its success which ensured to the travellers the most cordial reception and the most respectful attentions. It was an enterprise consonant with the spirit of the times, and nowise

* It is a remarkable fact that in this same year, 1761, our great astronomer Maskelyne was also at sea, and engaged also in instructing the officers of the ship in which he sailed in the lunar method, with a view to its general adoption by our navy, which subsequently took place.

solitary or strange. The King of Sardinia had sent the unfortunate Donati to the East: Asia was become an object of interest to Europeans from the war which the two great maritime powers were then waging in India: England began to send out ships to circumnavigate the globe. It was just that period of general satisfaction and delight in science and literature, in which mankind believed they had found the road that must inevitably lead to perfection: men of letters enjoyed great consideration; and everybody was ashamed not to regard the interests of science and of its followers as the most important interests of the human race.

In both places, they experienced the courtesy and charm of French reception; for, even in Malta, although the ruling body were of all nations, the prevalent manners were French.

The attentions paid in that island were more particularly directed towards Niebuhr; and in the false hope that his religious scruples might be got over, if, at the conclusion of his undertaking, he would become one of their body, the knights of the order offered him all the honours, distinctions, and advantages which they could confer upon him, without an open violation of their statutes.

From Malta the expedition proceeded to the Dardanelles, still on board the Greenland, which had taken its convoy to Smyrna. In the Archipelago, Niebuhr was attacked with dysentery, and was near dying. He recovered his health at Constantinople, but so slowly, that at the expiration of two months after the beginning of his illness he had scarcely made sufficient progress to go on board a Dulcignote vessel bound for Alexandria, without manifest danger. Here, for the first time, the travellers felt that they were really in the East. The plague broke out among the crowded Asiatic passengers: they, however, were exempt from it.

As we cannot follow him through his minute and accurate descriptions of the places through which he passed, we must content ourselves with a few extracts from his travels, calculated to throw light upon his character; to show that clear and dispassionate judgment, and that freedom from prejudice, which so admirably fitted him for a traveller among people whose opinions and manners are so entirely unlike our own. Passing over his description of Constantinople, we give in his own words his account of the first oriental people with whom he was thrown into close contact:—

"The captain," says he, "his clerk and his steersman, spoke pretty good Italian. The clerk had been not only in Venice and other Italian ports, but had travelled as far as Vienna. The Catholics had told him just as great calumnies of the other sects of Christians as the Sunnites relate of all Mohammedans but themselves. I once asked him, whether any heathens were to be found in the Sultan's dominions? In the course of his reply, he said, 'There are many in Germany and Italy; they are called Lutherans, and know nothing of God or the prophets.' In religious disputation, he shewed himself a true Mohammedan. One of our company endeavoured to convince him of the truth of the Christian religion. The clerk immediately rose and said, 'that people who believed in other gods beside the one true God, were oxen and asses,' and left the room. The good man thus gave us a hint, that we should do well to leave every body undisturbed in the belief that his own religion is the best, so long as he entertains no doubts about it himself. I did not hold it to be any part of my vocation to make proselytes. But when I afterwards inquired of enlightened Mohammedans, concerning the principles of their faith, I took the opportunity of explaining to them various matters relating to the Christian religion; and as I carefully abstained from asserting that it was *better* than the doctrines set forth in the Koran, none of them were in the least offended or displeased."

In Egypt the party remained a whole year, from the end of September 1761, till the beginning of October 1762, during which time Niebuhr visited Mount Sinai, in company with Forskaal and Von Haven. The party did not go farther inland than Kahira. During their stay in Egypt, Niebuhr determined the longitude of Alexandria, Kahira, Raschid, and Damietta, by means of numerous lunar observations, with an accuracy which the astronomers of Buonaparte's expedition, to their great surprise, found fully equal to that of their own. They, and the French army, not only found his chart of the two branches of the Nile equally correct, but even his ground-plan of Kahira, taken under the most difficult circumstances, in the

midst of an infuriated and fanatical populace.

"In the year 1801," says his illustrious biographer, "I laid this plan before a French officer who had risen from the ranks during the French revolution,—a man who could hardly write and was wholly unaccustomed to make use of ground-plans, with a view to gain some information concerning the entrenchments thrown up by the French army round the city, and the history of the great rebellion in Kahira. It was some minutes before he could translate the knowledge he had gained from personal observation into the symbolic language of drawing; but as soon as he caught the idea, he found his way, step by step, and could not cease wondering. My father, also, measured the height of the pyramids, and copied many hieroglyphic inscriptions on obelisks and sarcophagi."

At the time Niebuhr visited Egypt, very little information, worthy of credit, concerning that remarkable country, existed. Later travellers have added much to what he obtained; but when we consider under what circumstances of difficulty, and with how little protection, he added such vast stores to the stock of knowledge, we shall acknowledge that none have surpassed, or perhaps equalled him in industry, courage and devotion to his object. Of the obstacles he had to encounter, some idea may be formed from the following extracts.

At Alexandria, he says, "As I could overlook a great part of the old city walls, from the eminence on which Pompey's pillar stands, I took some angles of it from thence, and hoped that I might be able to take others from some other spot. One of the Turkish merchants, who stood opposite to me, and remarked that I had pointed the telescope attached to my quadrant against the city, was very curious to look through the glass, and not a little uneasy when he saw a tower upside down. This gave occasion to a rumour that I was come to Alexandria to turn the whole city topsy turvy. This report reached the governor's house. My janissary refused to accompany me when I took my instrument, and as I thought a European could not venture to appear in a Turkish city without a janissary, I gave up all idea of taking any more geometrical measurements here. Once afterwards, when an Arab of Raschid saw a ship upside down in my telescope, he was very near throwing the instrument on the ground. I learned by degrees to be very careful of the Mohammedans and their suspicions when taking my observations, which was the more necessary so long as I was unable to converse with them. . . . 'At an astronomical observation on the southern point of the Delta, a peasant was present, and behaved very courteously. As I wished to show him something he had never seen before, I placed the telescope of the quadrant opposite to his village, on which he was extremely terrified at seeing all the houses upside down. He asked my servant what could be the cause of this. He replied, that the government was extremely dissatisfied with the inhabitants of that village, and had sent me to overthrow it entirely. The poor peasant was greatly afflicted, and entreated me to wait long enough for him to take his wife, his children and his cow, to some place of safety. My servant assured him he had two hours good. He immediately ran home, and as soon as the sun had passed the meridian, I took my quadrant on board again. We must not wonder that Mohammedans were suspicious at the sight of these observations, since Europeans enough might have been found but a short time before, ready to believe every thing enchantment, which they did not understand."

He suggests the expediency of digging round the obelisk at Heliopolis, which, however, he had not the means to attempt. "The common Egyptians," says he, "are very unwilling that the Europeans should dig in the places where antiquities are found, from the idea that we are seeking for treasure. Perhaps, however, they would not forbid it, if the true motive of such researches were explained to the governor of the district, and the work done by his labourers. The peasants of Matare observed me very narrowly while I was measuring the height of the obelisk. They placed themselves at some distance, in consequence of their belief that I should throw up these huge stones into the air by some secret art, and take away the treasures concealed under them. This they were firmly resolved not to allow. They, however, did not speak an uncivil word to me, when they saw that their expectations were not fulfilled."

The following are the circumstances under which the plan of Kahira was

taken, to which his son alludes in the passage just quoted—

"With a view," says he, "of giving an accurate description of the size and situation of this city, I have given a plan of Kahira and the adjacent towns Bulak, Masr el Atîk, and Djize. This was really so troublesome, and, from the noted insolence of the Kahirians to all people of different religions, so dangerous a task, that no European had hitherto been found to undertake it, or will probably speedily undertake it again. I did, however, venture to measure all the streets, all at least which were thoroughfares, by paces, and to determine their bearings by a little compass. There are many parts, consisting entirely of little streets, which have no egress and can be entered only from the main street into which they all run. These are inhabited by labouring men and artisans, who, in the Eastern cities, do not work in their houses, but in little stalls or sheds in the Sûk or market place. As you cannot be supposed to be seeking any man in his dwelling-house, and as it is not the custom in the East to pay your respects to his wife or daughters, the people immediately conclude, if they see a stranger in any of these streets, that he has lost his way, and the first man who meets him, tells him that the street has no outlet at that end, and that he must turn back. It is, therefore, almost impossible for a stranger to obtain any knowledge of these quarters of the town."

One of the most remarkable objects in this city, is the palace of Joseph. "Here," says he, "is manufactured the magnificent cloth which is yearly sent as an offering to Mecca by the Sultan. The building still retains traces of its former splendour. In the room in which the weavers sit, the walls are covered with trees, houses, &c., in the most beautiful mosaic of mother-of-pearl, small stones of every variety, and coloured glass. On the walls of another room in which the cloth is embroidered, are some inscriptions in very good preservation. In a third the ceiling is very beautifully painted. Above, on the side of the Kara Meidân, where this great building is supported by a very high wall, springing from a steep rock, is a point commanding a magnificent view of the town, the surrounding country, and the pyramids. Some of the names of former regents of Egypt are engraved here. It appears that it was the residence of the Egyptian Caliphs and Sultans, and I could not help wondering that the Turkish governors do not inhabit it. I asked the overseer of the weavers, who not only conducted me about the building, but took me to his house and entertained me with coffee, after what Joseph this palace and a fountain in the city were named? He was of opinion that the palace was not more than 600 years old, and was built by Salaheddin, whose original name was Jusof."

Niebuhr's account of one of the most interesting phenomena in the world, the overflow of the Nile, is so curious, that we may be allowed to interrupt the course of our narrative a little longer, to insert it.

"When the Nile begins to rise, all the small canals which are led off from the main stream to water the adjacent fields, are stopped up and cleaned, and remain in that state until the water reaches a certain height. This height is ascertained by a Nilometer, on the island Rodda. For this purpose, a Sheikh is stationed there, who, as soon as he perceives that the water has risen at all, gives information of it. A number of poor people, who are already in waiting at Masr el Atîk, or Fostat, immediately hasten to Kahira, and each spreads the welcome intelligence through the streets of his own quarter. From this time, these people come daily at a certain hour to Fostat, and the Sheikh calls out to them from the islands, how many inches the Nile has risen.

"This is daily made public, until the Nile has reached the height at which it is appointed that the canal which runs through Kahira should be opened, at which time the tribute to the Sultan must be paid, and all anxiety about a scarcity is at an end. The information, however, thus proclaimed, is very little to be trusted. The Sheikh goes alone to the Nilometer, and always, at first, declares the height less than it really is; so that if, at a later period, the water should increase but little for some days, he may then be able to declare the rise greater than it is, in order not to alarm the inhabitants with the fear that the Nile should not reach the desired height. About the time when it was hoped the canal through Kahira would be opened, I sometimes went myself towards the mouth of the canal, to observe the height of the water against a high wall,

and I discovered that the rise which was proclaimed in the city was three times as great as I had found it to be. In the year when I was in Egypt, it was first proclaimed that the Nile had begun to rise on the 29th of June, and, on the 8th of August, that it had reached the height of sixteen Drâ or ells. Hereupon, the dam of the canal of Kahira was cut through with the customary ceremonies, which have often been described. We expected the water in the city, but in vain; for the canal had been so imperfectly cleaned that year, that it was not till the 10th that we saw a little water, whereas we ought to have been able to navigate the canal the first day. This extraordinary event caused a great agitation among the people. It was openly said, that the person who had undertaken to clean the canal would lose his head. He, however, paid a large sum to the government, and was compelled to make a new dam at his own expense, which was thrown across the canal on the 11th of August, and opened, without any ceremony, on the 12th.

"Gabriel Zionita, in his appendix to the description of Africa by the Sherif Edrîsi, mentions, as very extraordinary, that the Egyptians have certain tests, by which they can ascertain beforehand how high the Nile will rise, and whether they may expect a plentiful or a scarce season. This, indeed, they think so easy a matter, that almost every Egyptian woman, whether Christian or Mohammedan, imagines herself competent to it. It is the universal opinion in Egypt, that the Nile begins to rise in Habbesh, (commonly called Abyssinia,) on the night of the 17th of June; or, as they express it, that the drop (Nokka) which causes the rise of the Nile, falls. On that night, therefore, the women put a certain quantity of dough on the roofs of their houses, and if this has not increased in weight by the morning, *the drop* has not fallen. But, if the dough is heavier, it has fallen, and they then proceed to calculate with great certainty how many feet the Nile will rise, and what will be the price of corn for the year. As the weather is very regular and uniform in Egypt, it is possible that there is a heavier dew at this season of the year; and as the women never put out their dough except just on the night above-mentioned, they are always confirmed in their faith in the certainty of their test. As some of the Kahirians reckon time according to the Koptish calendar, the women were not all agreed on which night *the drop* fell. Other experiments of the same kind are yearly made, but intelligent Mohammedans regard the whole thing as mere pastime for the women."

The arrogant intolerance of the Mohammedans, which keeps pace with their ignorance and superstition, he describes as follows:—"The Jews, the eastern Christians, and even the Europeans, are allowed to ride only on asses in the city of Kahira, and from these they must alight whenever they meet a Bey, or any other Mohammedan of importance. These gentlemen never appear in the streets except on horseback. One of their insolent servants goes before, with a thick stick, and calls out to every Jew or Christian he meets riding on an ass, (unless he dismounts of his own accord,) 'Dismount!' If the command is not instantly obeyed, the servant often lets him feel the effects of his reluctance, without waiting to remind him a second time to pay the required homage to his master.

"A few years ago a French merchant was crippled for life, on one of these occasions. Our physician was insulted because he did not dismount quickly enough. This renders it impossible for any European to ride out here without a man who knows all those persons who claim the right to force people of a different religion to dismount. I rode at first with a Janizary before, and a servant behind, me. Both were Mohammedans, and remained seated, while I was compelled to alight. This annoyed me still more than the humble reverence I was obliged to show to the great men, and I afterwards went almost constantly on foot. Christians and Jews are also forbidden to ride past the mosques, and many other public buildings. Some, they are not even allowed to pass on foot. Yet I never could ascertain whether there was any positive law prohibiting them from riding on horseback in Kahira. Not many years ago there was a rich English consul in this city, who dressed like a wealthy Turk, and constantly rode on horseback. His fortune enabled him to visit all the Turks of distinction, and to entertain them in return. As he rode along the streets, he distributed alms largely, and became very popular. The consuls now ride on horseback only on the days on which they have audience of the Pasha. They are then very richly

and splendidly drest in the European fashion. I do not wonder that they are compelled to hear so many insulting expressions from the people on these occasions, for our short and straight clothing is, in the eyes of all eastern people, highly indecorous for a man of any respectability, and gold and silver are never seen on their garments. But all other times the Consuls wear the long Turkish dress, and are obliged to do like the eastern Christians and Jews, to dismount at the appointed places, or when they meet any distinguished Turks."

Niebuhr's accounts of the agriculture, the products, the implements and machinery, the trade and manufactures, the dress, manners, and amusements of the Egyptians, are full of interesting, clear, and accurate detail, and are, above all, marked by that perfect fairness and anxiety in no degree to exceed or warp the truth, which was, perhaps, his most striking characteristic. We have space only for a few sentences relating to the trade in gum arabic:—

"Among the products with which the Europeans are conversant, is the so called gum arabic, which the Arabs yearly bring to Kahira, in the month of October. They come in two or three small caravans, and the quantity is from six to seven hundred quintals. The trade is entirely in the hands of Mohammedan merchants. The Arabs never bring their wares into the city, but remain about a mile from Kahira, and the merchants must consent to go to them. They do not sell their gum by weight, nor do they show any samples, but keep it in untanned and closely sewed skins. They very rarely suffer a buyer to cut open these skins before the bargain is quite completed, and if any objection is afterwards made to the quality of their gum, they never take it back. Some of these Arabs mix little pebbles, sand, and bits of wood, with their gum. It might happen that they might afterwards be caught in the city, and probably for this reason: they give no credit, but exchange their gum for clothing, arms, or whatever they want, and immediately return to their deserts. I know not whether the Arabs deserve most the reproach of cheaters or of inexperienced dealers. They love freedom and few words. If they understood the art of spreading out their commodities, and calling to all passers by to look at them, those at least who had clean and good gum to sell would get a much higher price for it than they actually do. Most of it goes to Leghorn and Marseilles. In the months of April, May, and June, come many caravans from Africa, with three different sorts of gum, with elephants' teeth, tamarinds, slaves, parrots, ostrich feathers, and gold dust. They exchange these for linen, glass beads, coral, amber, sabres, and all sorts of clothes, which the Kahirians make according to the taste of the Africans."

The following is his description of the outfit of himself and his companions for their expedition to Mount Sinai.

"We had made careful provision for everything which we thought necessary for the journey before us; we had abundance of eatables, a tent, and beds. Most of the utensils carried on expeditions in these countries have already been described and drawn by other travellers; and, indeed, some of them are so convenient, that they might be introduced into European armies with great advantage. Our little kitchen apparatus was of copper, well tinned inside and out. Our butter we carried in a sort of pitcher made of thick leather. Table-cloths we did not want. A large round piece of leather was our table. This had iron rings attached to its edge, through which a cord was passed: after dinner it was drawn up, slung over a camel, and thus served the double office of a table and a bag. Our coffee-cups (saucers we had none) were carried in a wooden box covered with leather, and wax candles in a similar box, inclosed in a leathern bag. In the lid of this box was a tube, which was our candlestick. Salt, pepper, and spice we also kept in a little wooden box, with several lids screwed one over another. Instead of glasses, we had little copper cups, beautifully tinned within and without. Our lanterns were of linen, and could be folded together like the little paper lanterns which children make in Europe, only that our's had covers and bottoms of iron. Each of us was furnished with a water pitcher of thick leather, out of which we drank: and as we sometimes found no water for two or three days, we carried a good many goat skins filled with it. We also took two large stone water-jars with us, that we might be able to carry water ourselves on the journey from Suez to Djidda. Our wine we kept in large glass flasks, each holding twenty of our bottles. These vessels appeared to us the best for the purpose; but when a camel falls, or runs against another with his

load, they easily break, and therefore travellers in the East would do better to put their wine and brandy in goat skins. The hides which are used to contain water have the hair on the outside, but those for wine have it on the inside, and are so well pitched, that the liquor acquires no bad taste. And if Europeans do at first feel some disgust at drinking what has been kept in such vessels, they are, at least, freed from the fear of losing their wine, as we did. Wood or coals travellers seldom take with them. At the places where the caravans halt, they generally find the dried dung of beasts, and this they use as firing when they can procure no wood or sticks in the neighbourhood."

In October the party set sail for Suez, on board a Turkish vessel; they landed at Djidda, and reached Loheia, the first point of their proper destination—the country of Yemen—at the end of the year 1762. On this journey Niebuhr made astronomical, geographical, and geodætical observations, as often as possible, and made some inquiries respecting the currents. Out of these laborious investigations grew the chart of the Red Sea, which, with reference to the circumstances under which it was made, and the means at his disposal, may be regarded as a masterly work.

After some stay in this agreeable town, the party, especially Forskaal and Niebuhr, travelled through western Yemen, in various directions; the former botanizing, the latter ascertaining the geographical situation of places. They then returned to the sea coast to Mokha, where Von Haven died about the end of May, 1763.

At the same time Niebuhr was again attacked by dysentery, and was only saved by the greatest care and temperance. After many delays and difficulties, and before he was perfectly recovered, he set out, undismayed by the danger he ran, with the rest of the party, for the capital, Sana. The climate, and numerous annoyances, which Forskaal had partly brought upon himself, partly aggravated through his caprice, brought on a bilious disorder, of which he died at Jerim, on the 11th of July, 1763.

Niebuhr was the more depressed at his loss from his own protracted illness. He set out, with the two survivors, on the road to Sana, but without the slightest hope of returning, and fearful that no precautions could ensure those papers which were not left in the care of his English friends at Mokha, reaching Europe. This was a source of much greater anxiety to him than his life, to which he never held with any very great eagerness. He feared the entire frustration of the object, and, with good reason, the injustice which might be done to his and Forskaal's discharge of their duties. This was the only point of time during his whole expedition at which his spirits completely sunk.

At length he found himself in that state of dull resignation into which Europeans in the torrid zone generally sink, when under the influence of sickness and depression. He, who, both earlier and later in his journey, struck into the most toilsome path on the slightest rumour of an inscription or a ruin, could not now be stimulated to quit the high road to copy the Hamjarish inscriptions at Hoddafa;—an omission which any one, who imagines himself in his place, will easily excuse him for; but for which he used bitterly to reproach himself after a lapse of fifty years.

From the same causes the survivors declined the cordial and friendly invitation they received to pass a whole year in Sana and Upper Yemen; which would have been quite agreeable to the original plan. They hastened, on the contrary, to reach the coast before the English ships sailed. Their haste was much too great, for they had to wait the whole month of August, and more, before the vessel in which they were to sail was ready. Mokha, situated in the arid desert of Tehama, is, during summer, a horrible residence, and but few days elapsed before the surviving travellers and their servant were attacked with the fever of the climate.

Bauernfeind and the servant died at sea. Cramer reached Bombay, languished for some months, and died. Niebuhr was saved by that extreme abstemiousness which renders a tropical climate as little dangerous to Europeans as to natives. While he was labouring under the dysentery, the physician had told him to abstain from meat, and to eat nothing but bread and a sort of rice soup. This regimen cured his illness. At the end of several weeks the physician learnt, with astonishment, that Niebuhr was patiently continuing a diet by means of which few Europeans could be induced to purchase their lives, even when labouring under dangerous illness.

The merchant to whom the ship

which conveyed Niebuhr from Mokha to Bombay belonged, was Francis Scott, a younger son of the Scotts of Harden, a jacobite family of Roxburghshire. He became his intimate friend. "Five and thirty years afterwards," says his son, "when I studied in Edinburgh, I was received, in all respects, as one of the family in the house of this venerable man, who then lived at his ease in the Scottish capital, on the fortune he had acquired by honourable industry.

"The reception he met with from the English was extremely cordial. Bombay was, indeed, in a very different state from that which it now exhibits. The governor, instead of being a highly cultivated and scientific man, like many of those who have since filled that office, was, in conformity with the old system of the Company, a factor, who had risen by service; the council were men of low education and habits; the officers, for the most part, were men of various nations, who had entered an obscure service as a refuge from disagreeable adventures, or from indigence. Yet, even in this infant colony, the noble English spirit was not imperceptible; and, besides Scott, there were many in whom the vigorous, sensible, upright national character had wrought out for itself an education which cannot be given.

"In Egypt, Niebuhr had first learned to delight in the society of Englishmen; and there was laid the foundation for that mutual attachment, which was permanent, and of which I shall have occasion to speak more hereafter."

Among his most intimate friends were Captain Howe, of the Royal Navy, brother of Admiral Lord Howe, and of General Sir William. From him he received some admirably drawn charts of the Indian seas, and detached parts, roads and harbours of the south-eastern coast of Arabia. He had great pleasure in being able to requite his friend's gift by another, which might serve as a token of his gratitude to the English nation for their hospitality: this was, a copy of his maritime chart of the Red Sea which he had completed at Bombay, and which, from Djidda northwards, was new to the English, no British vessel having as yet navigated that sea. A few years afterwards they attempted the navigation of it with the aid of this very chart. Since that time it has been greatly improved and perfected by Englishmen: the eastern shore by Sir Home Popham; the western, which in Niebuhr's chart is deficient, by the expedition planned by Lord Valentia; the groundwork of these now perfect charts is, however, his.

At Bombay, Niebuhr learned the English language. He also endeavoured to acquire all the information possible from the Parsees and Hindoos, visited the excavated pagodas of Elephanta, and made drawings of the sculptures.

Lastly, he employed himself in arranging his journal, and sent a copy of it through London to Denmark. He also made use of an opportunity to visit Surat.

It was originally settled that the travellers should return by India: when, however, the inclinations which had first prompted Niebuhr to undertake the journey had returned in full force with the return of health, this plan displeased him, and he determined to make his way back overland. To achieve this, he was obliged to relax a little from the intense and wearing application to his original pursuit. From the time he quitted Bombay, where he learnt the death of his friend Mayer, (without whose examination and sanction he did not dare to trust himself, as he might and ought,) he gave up his observations for the longitude; to which he was further induced by the death of his Swedish servant, whom he had taught to assist him in the mechanical part of the observations. This is greatly to be regretted, for Persia and Turkey in Asia still present a wide and untrodden field for observations of this kind. Those who saw what pain this gave him in his old age, rather felt inclined to love and admire his zeal and modesty, than to lament the omission of a work he so much desired to perform.

In December, 1764, after a stay of fourteen months, Niebuhr quitted Bombay, visited Mascat, and made himself acquainted with the state of the remarkable province of Oman. He, however, did not remain there long, but went by Abusheher and Shiraz to Persepolis.

The drawings of the ruins, inscriptions and bas-reliefs of Persepolis, made by three preceding travellers, had forcibly drawn Niebuhr's attention to them as the most remarkable monument of eastern antiquity: no other, either in Asia or in Egypt, awakened such well-grounded hopes of being able to understand and interpret historical records

by a discovery of the meaning conveyed in the symbolical sculptures; and his acute and experienced eye immediately taught him the incompleteness of all the existing drawings. Nothing of all that he had seen in Asia raised his expectations to such a pitch; he could not rest till he reached Persepolis, and the last night of his journey thither was perfectly sleepless. The picture of these ruins remained during his whole life indelibly engraven on his mind—they appeared to him the crown and glory of all he had seen.

He passed between three and four weeks amidst them, in the desert, in unremitting labour, measuring and drawing the fragments. The inscriptions on the walls, which were at a considerable height, were distinctly legible only when the sun shone upon them; and as in this climate the hard polished black marble is not corroded by weather, his eyes, already greatly enfeebled by incessant labour, were attacked by a very dangerous inflammation. This, joined to the death of his Armenian servant, compelled him, in spite of his strenuous resistance to these complicated difficulties, to abandon the ancient sanctuary of Persia before he had thoroughly exhausted its treasures.

He returned by way of Shiraz and Abushehr, and from thence across the Persian gulf to Bassora. In Persia he collected historical documents concerning the fate of this unfortunate country, from the death of Nadir Shah up to his own times. With these he conferred a value little known on the German translation of Jones's History of Nadir Shah, the original of which was written in French. The information concerning that period furnished either by Olivier, or by Sir John Malcolm, is not (to use the most modest language) more valuable than that for which we are indebted to him.

In November, 1765, he went from Bassora through Meshed Ali and Meshed Hussein, two places of resort for pilgrims, but hitherto unvisited by any European, to Bagdad, and from thence through Mosul and Diarbekr to Haleb, where he arrived on the 6th of June, 1766. He was now perfectly at home: since he had been alone, he had been at liberty to conform, without molestation, to oriental manners and customs. He was, moreover, now living in a perfectly healthy country, and was as well as at any period of his life.

During this year and a half he had had scarcely any intercourse with Europeans, except at the remarkable Dutch establishment at Karek. In many of the large Turkish cities he visited were convents of Catholic missionaries; these men he regarded with the utmost aversion as disturbers of the tranquillity of the unfortunate native Christians, and of course shunned them. That among these missionaries, by far the greater number of whom were quarrelsome, malignant and ignorant, there were some scattered instances of such sanctity of life as is rarely to be met with in any other class of men, he bore ready testimony. At Bagdad he had become acquainted with Father Angelo, who had nursed many thousand people of every nation and religion in the plague, and whose life had been saved by a crisis which, to pious minds, appeared miraculous, when he was himself attacked by that frightful disease.

At Haleb, however, he found himself in a numerous society of consuls and merchants of all the nations of Europe, in consequence of the profound peace, living in undisturbed harmony. Some of them were married, and their houses afforded the charm of European domestic life, under the directing hand of woman.

His dearest and most intimate connexions were here also with Englishmen. Here he became acquainted with Dr. Patrick Russel, the author of the work on the Plague, and editor of his uncle Alexander's Description of Aleppo. "This respected friend of my father," says Mr. B. L. Niebuhr, "I had also the satisfaction of knowing many years afterwards, and of hearing from him many histories of by-gone days, told with a heart overflowing with the warmest affection and veneration."

Count Bernstorf had very readily consented to the extension of Niebuhr's journey. When this became generally known, the Count was solicited to allow him to visit Cyprus, for the purpose of copying again the Phœnician inscriptions at Citium, which might be supposed to be at least as incorrectly copied by Pococke as the Greek ones which he has given. He found no such inscriptions; and was inclined to suspect that those in question were only old Armenian inscriptions, (like some which he himself met with at Saline near Larneca,) badly copied by Pococke. It appears more probable that the stones had, in the interval, been removed.

An opportunity of going to Jaffa tempted him to visit Palestine, the geography of which was entirely undetermined by any astronomical observations, while no authentic ground plan existed of the topography of Jerusalem. In this he had made as much progress as the time permitted, in the beginning of August, 1766, when he retraced his steps to Jaffa, made an excursion from Sidon over Mount Lebanon to Damascus, and then returned to Haleb.

Five months and a half after his first arrival at Haleb, on the 20th of November, 1766, he set out to return directly home. He went with a caravan as far as Brusa. Lesser Asia, the land on the coast lying open to the south, excepted, is very cold in winter; and on the table-land of Mount Taurus our traveller suffered as much from frost, piercing winds and snow drifts, as he could have done in a winter journey in northern regions. In the warm and beautiful Brusa he reposed from this suffering, to which he had long been a stranger, employing his leisure, as usual, in working at his journal and charts. He reached Constantinople on the 20th of February, 1767.

He passed between three and four months in the capital of the Turkish empire, with which six years before, sick and a stranger in the east, he had been able to make himself but imperfectly acquainted. He had now seen many Turkish provinces, and knew their institutions and the revolutions which had taken place in them. In the capital he sought and gained information as to the general government and military establishments of the whole empire. His treatises on these subjects, remarkable for their solidity and completeness, are printed. Turkey in Europe can furnish attractive occupation only to scholars, to whom it is not Turkey, but Greece and Macedonia, and whose eye and imagination are ever in search of vestiges of past glory and greatness. Niebuhr travelled rapidly, through insecure and almost impracticable roads, to the Danube, and but little more slowly through Wallachia and Moldavia, in the capital of which latter the plague was then raging. About the middle of July he once more set foot on Christian ground at Zwanick.

King Stanislaus Poniatowsky, a man of refined and literary tastes, and imbued in the highest degree with that veneration for knowledge and science which characterized his age, had made known to the Danish government his wish that Niebuhr should direct his course homeward through Poland. He received the distinguished traveller with the manners of a polished gentleman, who takes the utmost care that his guest should not feel that he was invited as a curiosity. He effectually succeeded in winning our traveller's heart, and for many years a correspondence was carried on between them. Niebuhr, who had been so long without any intelligence from Europe, and knew nothing of what had been going on there, when civil war broke out in Poland, regarded the confederates as rebels, and his royal friend as a persecuted, but legitimate and excellent monarch.

On the way from Warsaw he visited Göttingen and his beloved native place, where the death of his mother's brother, during his absence, had left him in possession of a considerable marsh-farm. He reached Copenhagen in November, and was received by the court, the ministers, and men of science with the greatest distinction. Count Bernstorf, who knew how to appreciate him in every respect, and who moreover considered his own honour, as projector of the expedition, implicated in the manner in which it was achieved, appeared to wish to prove his gratitude to him by the most friendly and cordial reception. Niebuhr was intimately acquainted with him, and through him with his immortal nephew, the second Count, and with the Dowager Countess Stollberg, and her sons, then boys *.

Klopstock and the domestic friends of the minister were also in habits of intimacy with him. His own dearest and most confidential friends were Professor Krazenstein and his excellent wife.

His first business was to submit his accounts for inspection. From these he could not himself ascertain the whole cost of the expedition, since they did not include all the preparatory expenses; and it appears that he had neglected to procure for himself a copy

* The Counts Stollberg remembered how Bernstorf used to communicate Niebuhr's letters to their mother, and what a treat the reading of them was to themselves. These letters contained many lively traits which their author either did not think proper to insert in his journal, or omitted in writing his description of his journey, regarding them perhaps as trivial and of no importance to science. It is much to be regretted that we have not been enabled to avail ourselves of them for this biography.

of the general account. None at least was found among his papers, and he quotes another authority to prove that the whole expedition cost only 21,000 reichsthalers—(3,780*l.* sterling.) We recollect having heard another sum stated at Copenhagen, but it was very little higher; probably some information on the subject may be found in the Kiel journals of the time. The expense, on any calculation, was so extremely small as to excite the greatest astonishment. It would necessarily have been much greater had not Niebuhr been the sole survivor for nearly the whole of the last four years; but, although the sources of expense were thus greatly diminished, they were still more so by his scrupulous integrity;—not only in avoiding every outlay not essential to the object, but in paying out of his private pocket for everything which could be regarded as a personal expense.

"A far heavier account," says he, in the notes of his life which he wrote for his immediate friends, "was that which I had now to render to the public concerning my travels." The materials in his journal and papers were extraordinarily rich and various. That he now laboured at their arrangement and completion with all the truth and simplicity natural to him, will readily be believed; his distrust of his ability, however, amounted almost to despondency. We have already seen how he had grown up to manhood almost entirely without acquaintance with literary pursuits: nor was this all; he had read little connectedly, especially in German. The high German, or written language of Germany, was not his mother tongue; it was only as a young man that he had familiarized himself with it, nor was he ever master of it in all its extent and richness. But he was still more afraid lest, from want of learning, he should state facts in an erroneous or incongruous manner, and consequently be misunderstood and unfairly judged.

His first notion was to publish two works before he published his travels; the one consisting of replies to the queries addressed to the members of the expedition, to be extracted from his own and Forskaal's papers, the other of a collection of all his astronomical observations.

It might certainly have been expected that some queries would have been digested and given to men whom Michaelis was sending to explore new countries, and that a solution of them would have been demanded. So far, however, was this from being the case, that more than four years after the first conception of the project, when the expedition sailed from Copenhagen, he had prepared only two very insignificant questions; the remainder they received, at three several times, on the journey.]

Incomparably more important than any of these, was the paper containing topics of inquiry concerning the history of Yemen, compiled by the *Académie des Inscriptions et Belles Lettres*, with that true oriental erudition for which France had long been distinguished. A translation of them is to be found in Niebuhr's works, after the queries of Michaelis. As the latter are well known, the public can judge whether they deserved answers, and whether it was possible to answer such questions satisfactorily. The philologist of the expedition was, at all events, totally incompetent to the investigation; it was Forskaal, indeed, who took it upon himself, and who, from the diversity of his talents and knowledge, was the only person at all fitted to it. As long as he lived, Niebuhr, who understood nothing of Hebrew, regarded these inquiries as only indirectly connected with his pursuits; though, indeed, he neglected nothing which could be of the slightest utility to science. When, however, he remained the solitary survivor, he spared no labour in collecting answers to the queries. He thus fulfilled, to the utmost extent, all that could be required of him. To him, what was accomplished appeared very little, and the extreme modesty of the expressions in his preface ought to have disarmed even such enmity as that displayed in the attack upon him in Michaelis's biography.

As he now thought, and with justice, that these answers were too insignificant to form a work distinct from his great one, there were other causes which decided him not to publish the astronomical observations separately.

His fears concerning the accuracy of his lunar observations, and the calculations founded upon them, have already been mentioned. Had Mayer lived, he would have examined them, and, once assured of their accuracy by him, Niebuhr would certainly have published them with perfect confidence. He, however, could now find nobody on the continent who was master of Mayer's

method, and willing and able to tranquillize his fears and encourage his diffidence by examining them.

It was also a most adverse circumstance for him that Father Hell, who had been sent to Wardöhuus to observe the transit of Venus in 1769, was then staying in Copenhagen. Father Hell was unquestionably an able astronomer, but prone to depreciate and to thwart the works of all other men. This accounts for his having taken pains to decry the quadrant which Niebuhr had constantly and most ably used, as an imperfect instrument;—a matter upon which he completely altered his tone when he took this very instrument with him to Norway. He was a declared enemy to Mayer's method; and as Niebuhr, with all the humility natural to him, acknowledged his superiority as a scientific astronomer, Father Hell took advantage of this to increase his diffidence as to the value of his observations, and to maintain that the only certain method of ascertaining the longitude was by the eclipses of Jupiter's satellites. Niebuhr had also made some observations of these eclipses. The scientific readers of his travels will recollect that the longitude of Loheia is determined by them, and that he ascribed the calculation to Father Hell. The impression which the crafty jesuit made upon his mind with respect to his lunar observations, was in the highest degree unfortunate. He had not, indeed, lost his own faith in his observations, but he now feared doubly for the reception they would meet with from the public, and thought he should be compelled to abandon them until somebody should be found who would examine and verify them. This was afterwards done by Bürg.

He now came to the resolution to work up his materials in the form in which they afterwards appeared. For the publication of these two works, Bernstorf procured him very liberal support from the Danish government. All the copper-plates were executed at its cost, and given to Niebuhr. The rest of the expenses he defrayed, having adopted the unfortunate plan of publishing the works himself.

While he was occupied in preparing his description of Arabia, the political circumstances of Denmark changed in a manner the most painful to him. Struensee had got possession of the government, and even of absolute power, and Count Bernstorf was dismissed. Niebuhr did not think fit to take upon himself the character of a public man; his desire on this, as on other occasions, was not to be conspicuous; but he was far from disowning his warm attachment to Bernstorf at a time when all the timid fell off from the discarded minister: Niebuhr, with a very small number of faithful friends, accompanied him to Roeskilde. He never deigned to pay a visit to Struensee, nor would he appear in any place where he was likely to meet the mischievous despots of that unparalleled epoch. He spoke his mind freely; he rejoiced when the people rose against the enemies of their country, and shared the triumph of their downfall.

The Description of Arabia appeared at Michaelmas, 1772. A book of this kind could not become popular; it was, indeed, fitted only for the few. It is, however, difficult to understand how a critic could be found with effrontery enough to write such a review of a book so truly classical, so full of information, and, at the same time, of modesty, as that which appeared in the Lemgo Scientific Journal. It was manifestly dictated by a desire, not to enlighten the public, but to destroy the book. Personal hostility had blinded the writer, or envenomed his mind; he, however, attained his end—he deeply wounded an unpractised author, whom the cool reception of the public had already sufficiently discouraged.

Niebuhr expected that his work would excite a more lively interest abroad than in Denmark; and the appearance of the French edition, which he published the following year, seemed well calculated to realize his expectations. In publishing this, however, two great errors were committed, which increased the influence of the adverse star that presided over all his literary undertakings. The translation ought to have appeared at the same time with the original. Time had now been given for a Dutch publisher to make the same speculation, and the two translations came out at the same time. But however bad and impure was the French of Holland, and to however small a portion of praise the translation which appeared there is entitled, it unfortunately happened that the one made at Copenhagen by a refugee priest was much worse. So utterly unreadable, indeed, was it, that nothing but its

novelty could have procured it any notice whatever. Niebuhr, who understood only just so much of the language as was necessary to make himself understood, was unhappily no judge of this, and threw away all the money this abortive undertaking cost him.

At this time a sort of diplomatic messenger, sent to several of the northern courts of Europe by the Pasha of Tripoli, arrived at Copenhagen. His name was Abderrahman Aga. The object of his mission was to beg those presents for his master, which the feeble government of Tripoli had no longer power to extort. It was also a favour conferred upon the ambassador, who was entertained at the cost of the courts he visited, and received presents for himself. The Danish ministry had assigned him a man as companion and attendant, who had formerly been consul in Barbary, and was supposed of course to understand Arabic. The Tripolitan, who was a very intelligent man, found him extremely dull, and almost entirely ignorant of the language he was employed to interpret. Niebuhr, who cherished the feelings of a countryman towards all orientals, visited Abderrahman. He was delighted with an opportunity of speaking and hearing Arabic, of reviving his already diminished facility in it, and of gaining from a native, information concerning the regions where that language is spoken which he had not visited. From him also he gained much interesting intelligence of Tripoli and Barbary. The details which he gathered concerning middle Africa were of a much more important kind; and are the first calculated to throw any light on those unexplored regions, collected since the time of Johannes Leo Africanus.

During two centuries and a half the numerous Europeans who returned from the northern coast of Africa and from Egypt, had not contributed the smallest addition to the stock of knowledge on this subject; and geographers could only, with different degrees of critical acuteness and of intelligence, compare and adapt the accounts given, at an interval of four centuries, by Sherif Edrisi, and by Leo. D'Anville's acuteness in divining the geography of Africa, viewed with reference to the extreme poverty of the data, appears perfectly marvellous. Niebuhr's details were collected sixteen years before that passion arose in England for the discovery of Africa, which has since led so many travellers thither. Their accuracy has been wonderfully confirmed, and they afford one of the most convincing proofs of his talents for geographical research.

Abderrahman Aga visited many of the countries and capitals of Europe, but Niebuhr was the only man then to be found who knew how to turn this opportunity to the account of science. His testimony was most valuable. He had not, indeed, crossed the Sahara, or visited Negroland, but he traded thither; and besides the interest which he took in the country as a merchant, he had that ardour for geographical research which is very extensively diffused among the nations of the east, and is promoted by the paucity of their subjects of conversation. He likewise had some knowledge of the Negro languages: from him, and from one of his black servants, Niebuhr collected various specimens of these dialects.

The discovery of two great Mohammedan and civilised kingdoms in central Africa; the Tripolitan's assurance that a traveller, sufficiently acquainted with eastern manners and customs to pass as an Asiatic, would meet with no greater difficulties there than in Arabia, and with less fanaticism than in Egypt; the undoubted good faith and cordiality of Abderrahman's invitation, and of his promise of all possible recommendations and assistance; the consciousness of the knowledge, aptitude, and familiarity which he had acquired, joined to that longing after the deep and solemn tranquillity of Eastern lands, which other Europeans who have been long resident in them have felt;—all these causes united, awakened in his mind so intense a desire to travel by way of Tripoli and Fezzan to the Niger, that he would probably have set out at his own expense, without any assistance from the government, had he not been withheld by the duty of first finishing the account of his travels. Whatever were the countless dangers which threatened him, we are justified in believing that in all human probability he would have surmounted them. The Moorish merchants, who, through the first injudicious visits of the English expedition, became suspicious and jealous, would have received him without any hostile feelings, and for the difficulties of the journey he was as well prepared as an Asiatic. His talents and fitness for the undertaking were too peculiar and remarkable, and too tho-

roughly tried, not to promise him results greater than those which any other traveller, excepting only Brown, could expect.

But the course of his life was now to be changed. Had he remained single, he would have hastened to finish his work, in order to attempt this attractive adventure; but at this very time he became acquainted with the daughter of the deceased physician Blumenberg, a Thuringian, and was soon betrothed to her. This was his first and only love; and that it was deep and strong is sufficiently proved, by his sacrificing to it the journey of discovery which he had so passionately desired, and the oriental life which was so agreeable to him. He married in 1773. His wife bore him two children, a daughter, and B. G. Niebuhr, the illustrious author of the most learned and valuable researches into the history of Rome which have ever appeared, from whose life of his father this memoir is chiefly taken.

The first volume of his travels appeared at the Easter fair of the following year, 1774. This caused him to visit the fair; but, even had he not been led to Leipzig by business, he would have been induced to go by his desire to become personally known to Reiske. If any man in Germany ever experienced the misery of persecuted excellence, it was Reiske, whose cotemporaries could not but admit, that if any imperfection now and then appeared in his learning, it arose only from the extent and fulness of his genius and imagination; and that what was ill natured and unamiable in his writings, was the offspring of his bitter feelings at being trodden underfoot by the tyranny of literary envy. "It is not without pride," says Mr. Niebuhr, "that I affirm that my father and Lessing were the only men who did honour to him while living: my father publicly bore testimony that, even among the Arabs themselves, he had never met with a man so profoundly versed in their literature."

In spite of the very unfavourable experience he had already had of publishing on his own account, he held himself bound by a sacred duty to his departed friend to publish Forskaal's works on natural history. This acquittal of a debt to friendship occasioned him a greater loss than all his other publications, from the unavoidably small sale of the work. It was impossible to print from manuscripts in so confused a state, nor could Niebuhr undertake to arrange them, totally unacquainted as he was with the natural sciences, and little versed in the Latin language. He entrusted the task to a Swedish man of letters, and paid him a very considerable sum for its execution. This Swede was a strange man, and, among other things, importuned Niebuhr to let the preface appear in his name; his compliance with which was afterwards a cause of great regret to him. The extraordinary value of this neglected and forgotten work has been mentioned.

Already discouraged by the very considerable sums he had either wholly sunk, or, at least, locked up for a long time, in his literary undertakings, he delayed the publication of the second volume of his Travels, which did not appear till 1778. According to his original plan, this ought to have come down to the termination of his expedition; he broke off, however, at his arrival at Haleb. The remainder of the journey, together with remarks on the Turkish empire, on the Mohammedan religion, details concerning Abyssinia which he had collected at Yemen, and those relating to Sudan which he had obtained from Abderrahman Aga; lastly, the whole of his astronomical observations, were to compose the third volume, which he then thought would very soon follow the others, but which never appeared, though he was so often and so earnestly urged to publish it by his friends and admirers. The causes which hindered his complying with their wishes will be stated in the sequel of this narrative.

He lived very contentedly at Copenhagen, in the bosom of his family, and of a small circle of friends; but the loss which he sustained from the retirement of Count Bernstorf was never supplied. Misunderstandings and differences some time afterwards troubled his outward comfort; and as he easily took a disgust at a place of residence in which he had experienced vexations, he began to grow averse to this city, although he had lived happily in it for ten years, particularly as he heard that General Huth intended to send him into Norway on a geographical survey of that country. This mission was extremely distasteful to him; he did not like to be separated from his family, and he could not take them with him into the wild mountains of Norway. He therefore endeavoured to quit

the military service, and to obtain a post in the civil service of Holstein. The government acceded to his wishes, and gave him the situation of secretary of the district (*landschreiber*), at Meldorf; an office, the duties of which were not at that time very burthensome. In the summer of 1778, he arrived with his family at that place, in which he remained till his death.

Meldorf, the chief town of the old republic of Ditmarschen, formerly rich and populous, is sunk into obscurity and desolation. It was twice taken, plundered and burnt, both in the successful war of subjugation, and in that of vengeance and liberation, which followed it. This, added to the grievous contributions extorted from it in the thirty years' war, and the famine which arose out of the universal decay in which the country languished from the year 1628, till the rise of the price of corn in 1790, completed its ruin. Numerous vestiges of the good old times are, to those acquainted with its history, melancholy memorials of its lost and irrecoverable prosperity. Quiet and deserted as the place was, it may readily be supposed that it was entirely without the sort of society suited to a man of Niebuhr's tastes and character; for he was, unfortunately, little versed in the learned languages, and he remained a stranger to the excellent man who is still the ornament of the place, until he became indebted to him for the philological education of his son.

Meanwhile he settled his plan of life; built himself a house, the massive style of which showed his love for the plain and substantial dwellings of his fathers, and planted a garden, the fruit of which he was at that time in too delicate health to hope to gather. He, however, outlived most of the trees in it. In these employments, and the acquisition of knowledge of the country, several years slipped away, during which he began to lose sight of the termination of his work; indeed, this daily became a source of increased pain and mortification to him, from an increasing perception of the pecuniary loss it had caused him, and from the great indifference to it which then prevailed in Germany.

At this time, too, he sustained a loss which rendered him, as father of a family, more thoughtful as to the sacrifice of a part of his remaining property for so unthankful an undertaking. A passion for speculation seizes on reflecting and intelligent, but inexperienced, men, as well as on the reckless and inconsiderate; as epidemical complaints attack the strong as well as the weak. During the American war the rage for shares in a joint-stock undertaking prevailed in Copenhagen, and was fostered and heightened by delusive appearances. Niebuhr was one of those who suffered themselves to be tempted to buy Asiatic shares, and wait for a higher and higher premium, till at length they reached a price for which there was no foundation; this ended in their sudden fall, and in the loss of the holders.

Many things now conspired to trouble his tranquillity. He himself, as a native marshman, enjoyed very good health in the air of Ditmarschen; but his wife, like all strangers, had to struggle against continual attacks of fever, and her delicate constitution was thoroughly shaken. Niebuhr had employed himself for many years, though of late with considerable interruptions, in arranging and preparing his works. He now entirely laid them aside. With the same view he had read a great deal; he was now in a place in which no book ever met his eye, which he did not himself procure. The void which this occasioned was extremely oppressive to him and disheartened and indisposed him for his labour: the more so, as the dead stagnation of a place in which no day was ever marked by a new occurrence, was contrary to his nature, to that impulse which had driven him out into the wide world, and to the very varied and eventful life to which he had been accustomed. The void indeed which he felt was one which no books could fill; and, as he did not clearly define it to himself, it hung upon his spirits as a silent discontent. The direction of his mind was exclusively towards the historical knowledge of things which form a part of the existing and visible earth. Even the history of the past ages of the human race was for him a merely subordinate study. From the same peculiar character of his mind, even astronomy, his own proper pursuit, had no charms for him, except as serving to illustrate geography. When he built his house, he had fitted up a room as an observatory, and made observations there and in other parts of Holstein for the sake of ascertaining the situations of places: latterly, however, he discontinued this more and more, and the instruments he had used on his travels were preserved only as relics.

It was a most fortunate and beneficial thing for him that, a few years after he settled at Meldorf, Boie was sent thither as *Landvogt,* or governor of the province. The editor of the "Deutches Museum" had, of course, very extensive literary connexions, and the intercourse between men of letters was then carried on with a vivacity and interest now wholly unknown. On every account, therefore, he was capable of furnishing various interesting matter about which Niebuhr's mind busied itself. An intimate and daily intercourse, which formed part of the regular routine of their lives, accordingly arose between these two men, and, when Boie married, between the two familles.

Through Boie's means Niebuhr also became acquainted with men who would otherwise never have visited this remote and obscure corner. In this manner he obtained the acquaintance and the friendship of the celebrated poet and scholar, Voss.

Another and not less considerable advantage which arose out of Boie's residence at Meldorf was, that he possessed a very fine library, which, as editor of the "Museum," he was continually increasing. The greater part of the books were, it is true, foreign to Niebuhr's tastes and pursuits, but there were many which interested and occupied him.

One consequence of this connexion was, that he was stimulated to write many papers, which circumstances called forth, for the "Museum;" and to give treatises to that periodical, which had been intended to form part of his third volume, and were laid on the shelf. This was, in more than one way, disadvantageous to him. It tended to extinguish all purpose of publishing the deficient volume; it dissolved the connexion in the matter, and destroyed its integrity; and was so much given away out of the newest and most important parts. He seldom wrote for the press without constraint, or without dread of committing errors in style. This anxiety was greatly increased by Boie's fastidious criticism. Niebuhr gave him his manuscript to read through, as he had been in the habit of doing to a friend in Copenhagen. He was not, however, content with erasing a few obvious errors, but corrected it throughout with such rhetorical nicety, that Niebuhr was now more than ever convinced of his entire inability to write. In this he was quite wrong; for the style of those of his essays which had not been touched by any other hand, not only characteristically expresses his peculiar modes of thinking, but is remarkable for the simple beauty it derives from the Low German idoms, which sometimes appear faintly, sometimes in undisguised and primitive plainness. To Northern Germans they have a peculiar charm, and none but a taste, enfeebled and depraved by fastidious refinement, could ever take offence at them.

Meanwhile his children grew to an age to require instruction. This he gave them himself. "He instructed both of us," (says his son,) "in geography, and related to us many passages of history. He taught me English and French—better, at any rate, than they would have been taught by any body else in such a place; and something of mathematics, in which he would have proceeded much farther, had not want of zeal and desire in me unfortunately destroyed all his pleasure in the occupation. One thing indeed was characteristic of his whole system of teaching:—as he had no idea how any body could have knowledge of any kind placed before him, and not seize it with the greatest delight and avidity, and hold to it with the steadiest perseverance, he became disinclined to teach whenever we appeared inattentive or reluctant to learn. As the first instructions I received in Latin, before I had the good fortune to become a scholar of the learned and excellent Jäger, were very defective, he helped me, and read with me Cæsar's Commentaries. Here, again, the peculiar bent of his mind shewed itself;—he always called my attention much more strongly to the geography than the history. The map of ancient Gaul by D'Anville, for whom he had the greatest reverence, always lay before us. I was obliged to look out every place as it occurred, and to tell its exact situation. His instructions had no pretension to be grammatical;—his knowledge of the language, so far as it went, was gained entirely by reading, and by looking at it as a whole. He was of opinion, that a man did not deserve to learn what he had not principally worked out for himself; and that a teacher should be only a helper to assist the pupil out of otherwise inexplicable difficulties. From these causes his attempts to teach me Arabic, when he had already lost that facility in speaking it without which it is impossible to dis-

pense with grammatical instruction, to his disappointment and my shame, did not succeed. When I afterwards taught it myself, and sent him translations from it, he was greatly delighted.

"I have the most lively recollection of many descriptions of the structure of the universe and accounts of eastern countries, which he used to tell me, instead of fairy tales, when he took me on his knee before I went to bed. The history of Mohammed; of the first caliphs, particularly Omar and Ali, for whom he had the deepest veneration—of the conquests and spread of Islamism—of the virtues of the heroes of the new faith, and of the Turkish converts, were imprinted on my childish imagination in the liveliest colours. Historical works on these same subjects were nearly the first books that fell into my hands.

"I recollect too, that on the Christmas-eve of my tenth year, by way of making the day one of peculiar solemnity and rejoicing to me, he went to a beautiful chest containing his manuscripts, which was regarded by us children, and indeed by the whole household, as a sort of ark of the covenant;—took out the papers relating to Africa, and read to me from them. He had taught me to draw maps, and with his encouragement and assistance I soon produced maps of Habbesh and Sudan.

"I could not make him a more welcome birthday present than a sketch of the geography of eastern countries, or translations from voyages and travels, executed as might be expected from a child. He had originally no stronger desire than that I might be his successor as a traveller in the East. But the influence of a very tender and anxious mother upon my physical training and constitution thwarted his plan almost as soon as it was formed. In consequence of her opposition, my father afterwards gave up all thoughts of it.

"The distinguished kindness he had experienced from the English, and the services which he had been able to render to the East India Company by throwing light on the navigation of the higher part of the Red Sea, led him to entertain the idea of sending me, as soon as I was old enough, to India. With this scheme, which, plausible as it was, he was afterwards as glad to see frustrated as I was myself, many things in the education he gave me were intimately connected. He taught me, by preference, out of English books, and put English works of all sorts into my hands; at a very early age he gave me a regular supply of English newspapers;—circumstances which I record here, not on account of the powerful influence they have had on *my* maturer life, but as indications of *his* character.

"He entered with the greatest indulgence and interest into the half precocious, half infantine thoughts of the boy; built castles in the air with him; conversed with him upon all the topics of the day, and communicated to him his ideas and views on all subjects that came under discourse. Thus, when we spoke of fortification, he brought out books and plans, and made me draw and measure polygons.

"In the winter of 1788, Herder sent him his Persepolis, the contents of which were extremely interesting to him. This gave him the greater pleasure, as it was the first proof he had received for many years that he was not forgotten by his countrymen—a pleasure mingled with surprise. From that time marks of the estimation in which he was held in Germany, as well as abroad, were continually becoming more frequent."

The war with Turkey, which broke out at this time, occupied his mind intensely, and excited him to write several papers. The warmer was his attachment to the Arabs, and the more the peculiarity of his character led him to regard the Arabs of Medina, Bagdad, and Cordova, under the kaliphs, as the people after his own heart, the more intensely did he hate the stately, unbending Turks—the tyrants and oppressors of his beloved Arabs—and he cordially wished that they might be driven out of that Happy Land, which under their government is becoming a desert.

He could not, however, help grudging this conquest to the French; and, during the expedition to Egypt, his lively acquaintance with what Egypt had been, was, or might become, rendered it impossible to mislead him; it was his persuasion that, from the French, no improvement, no relief could or would come. For it must be acknowledged, that towards the French he had a national antipathy, although he gratefully remembered that in many places in the East they had received him with the most sincere and courteous hospitality; and although he entertained the highest possible respect for their mathematicians and orientalists. At a later period,

when the revolution broke out, he beheld it wholly without faith or confidence in any good result, and even with a decided aversion, excited by that national vanity and that want of veracity which were but too obvious and too disgusting to a mind so simple and upright as his. Not that he had any attachment to courts, aristocracies, or priesthoods. He did not philosophize on the subject, but saw in the French nation our hereditary enemies. He rejoiced at the breaking out of the revolutionary war, from the hope that we might regain the several German and Burgundian provinces, which he always, when teaching his children geography, persisted in reckoning as parts of Germany.

The neighbourhood of his native place was one of the reasons which made it particularly agreeable to him to live in Ditmarschen. Of his relations, his half brother, Bartold Niebuhr, and his nephew, H. W. Schmeelke, were the nearest and dearest to him. The former, many years younger than himself, an opulent farmer, died unmarried long before him. He was a man of extraordinary capacity, and although he had gone but occasionally to school, and (as everything was easy to him) applied but very little, he had acquired enough of the Latin language to understand the poets. "Uncle, what are you reading there?" said his nephew to him one day, seeing him with the Georgics in his hand. "I have hived some bees," answered he, in the dialect of his country, "and I want to see what Virgil writes about them."

When he saw Niebuhr in his uniform as officer of engineers, he went up to him, looked earnestly at him, and said, smiling, "Brother, you look very well in that dress, but for all that you are a servant—I am a free man." Schmeelke, for some time Bürgermeister (*i. e.* chief magistrate) at Otterndorf, was always Niebuhr's favourite, and before his travels into Arabia he had bequeathed to him the greater part of his property, as his brother did not want it. The uncle and nephew frequently exchanged visits, and Niebuhr was never so happy as in Hadeln. He had no relation, however distant, no connexion of the friends of his early youth, whose circumstances he did not know in their most minute details and treasure up in his memory.

"The appearance of the long-expected travels of Bruce," says Mr. Niebuhr, "formed an epoch in our uniform life. My father had never been one of those who carried scepticism so far as to question whether Bruce had ever been in Abyssinia at all. He read his work without prejudice, and the conclusion he arrived at was the same which is, since the second Edinburgh edition, and the publication of Salt's two journeys, the universal and ultimate one. In a paper which he sent to the new 'Deutsches Museum,' he showed that Bruce had exactly copied the pretended determination of the elevation of the Pole on the Arabian Gulf from himself;—that the conversation with Ali Bey was a palpable fabrication and romance;—that the pretended journey over the Red Sea, in the country of Bab el Mandeb, as well as that on the coast south from Kossir, were also mere fiction. On the other hand, he declared that, mixed up with these gross falsehoods, there were parts of the travels which bore an impress of perfect truth and might be confidently believed. About the same time, he was incited, half in indignation, half in wantonness, to give his opinion on a fantastic dream concerning the origin of the Pyramids and of Persepolis put forth by Witt, who maintained that they had been wholly misunderstood, and were works of nature.

At the beginning of the year 1790, he had the great pleasure of receiving a letter from his old friend Dr. Russel, begging of him his ground plan of the city of Aleppo for the new edition he was about to publish of his description of that city. It is hardly necessary to say that Niebuhr did not refuse it. Dr. Russel greatly improved upon it by the addition of the most remarkable buildings, by more correct drawing of the principal streets, and omission of the remainder. Niebuhr's plans, with the exception of Kahira, which is as perfect as that of any city in Europe, are, as he himself has observed, to be considered complete only as far as the circumference, the gates, and the principal build ings are concerned.

Out of this renewed correspondence with Dr. Russel, arose one with Major Rennell, who wished to avail himself of Niebuhr's unpublished map of his route through Syria and Natolia, with a view to a general map of Asia he had it in contemplation to publish. Niebuhr was too generous and too free from all petty jealousy to hesitate a moment in complying with this request. About the same time, Marsden showed his respect for him by sending him his history of Sumatra.

After the correspondence with Rennell had lasted some time, Niebuhr sent him a few of his lunar calculations, the verification of which he had so extraordinarily at heart, and intreated him to induce Maskelyne to undertake this task: this, however, was not attended with any success.

"I must here," adds his son, "depart from chronological order to speak of his correspondence with two excellent men of letters, which, however, if I mistake not, took place some years later. Silvestre de Sacy, while deciphering the Pehlwi inscriptions at Nakschi Rustam, had discovered the incomparable accuracy of my father's drawings; and he, who always entertained the highest reverence for the author of that masterly philological work, felt grateful to De Sacy for calling into life labours which were dead, so long as the key to them was wanting. A very agreeable correspondence soon arose between two men of science, bound to each other by such ties. Silvestre de Sacy was at that time employed upon the compiled translation of the Bark el Jemen, *i. e.* the History of the Conquest of Jemen by the Turks. In the prosecution of this work he had used my father's geography in his description of Arabia and his map of the empire of the Imaums, and had found the astonishing result that every place mentioned in the history, excepting only two villages in Tehama, were laid down with perfect accuracy. So far as the map was determined by his actual progress through the country, this is less surprising; the remarkable, and the far greater part, is that which rests on the connexion between such data concerning distance and direction as he could collect. Here nothing but the most acute judgment and accurate induction could have enabled him to decide on the internal evidence of varying testimonies, and to give to each its due value.

"Out of this correspondence afterwards arose another, which was also extremely valuable to him—that with the learned, industrious and clear-sighted geographer, Barbier du Bocage. He applied to my father for materials for the construction of his map of Natolia, and received both astronomical determination of places, and itineraries which my father had written down from the oral testimony of the camel-drivers of the caravans."

In November, 1792, Niebuhr was attacked by a pleurisy of which he very nearly died, and recovered very slowly. Fulness of blood, occasioned by the quiet and inactive life he had led for so many years, was the cause of very severe illness and of long derangement of health. The following year he spit blood. He was not absolutely ill, but his spirits were extremely languid and depressed: he complained of oppression on the chest, and indisposition to move. He had another complaint which made him very anxious. For several years a sort of wart or wen had been growing under his right eye, and every means resorted to had only inflamed and increased it. The surgeon whom he consulted thought it alarming; the more so because he dared not venture on an extirpation. After enduring pain and anxiety for some years, it was at length cured, and at the close of his sixty-sixth year he was happily restored to perfect health. An accident led him to purchase some moorland, a league from his house, and to undertake the cultivation of it. It revived all his taste for the employment of his early life; he laid various schemes of agricultural improvement, pursued them with youthful ardour, and promised himself the most favourable results: he planted trees, cut drains, and bought land till he had altogether a very considerable estate. The consequences were not answerable to his hopes; a great deal of money was lost—if, indeed, that can be called lost which not only left the land improved and productive, but lengthened and enlivened his remaining days.

He took much and strong exercise, went to his farm on foot or on horseback, returning with unwearied activity to every spot where anything remained to do. As the fields in that part of the country are divided by very broad ditches, he made use of a leaping pole, to which he had been accustomed in his youth. He had grown so young and so robust, that he jumped over a ditch ten feet wide in his seventieth year. His farm made many things interesting to him which had formerly been indifferent, and his peculiar talent for observation and investigation found animating employment and food. He studied, in the greatest detail, the sort of agriculture suited to the marsh and heath lands of his own district and the neighbouring ones on the same side of the river, and all the long-forgotten knowledge of the subject which he had acquired in his youth from personal observation revived in his mind. "I still hope," says his son, "to ob-

tain possession of a series of letters from him, written in the year 1801, in which most careful inquiries, he replied to a list of queries I addressed to him on the different kinds of marsh-land, the under strata, the proportion between the seed and the produce of various sorts of grain, and the fundamental rules of the old valuation of the land, with a precision and copiousness to be expected only in replies to the interrogatories of a committee of the British House of Commons.

"Still later, in 1809, in the 77th year of his age, he surprised me by a collection of notes in answer to the inquiry whether, before the existence of the marshes along the whole coast of Friesland, from Jutland to the Vlie, there had been moors extending behind the *Dunes* or Denes, which are now washed away; as also, in answer to the question, whether the mean height of the tide were always the same, and had not, for a long series of years, been continually gaining, or were subject to long periods of gaining and losing. These queries were contained in a letter addressed to him from Holland. The facts which he brought together in reply, gave evidence of all his peculiar acuteness and accuracy of observation.

"These occupations diverted him from dwelling on a misfortune which had been a source of great vexation to him for some years before he devoted himself to them. The copperplates belonging to the works which had appeared, as well as those executed for the yet unpublished volume, were deposited at Copenhagen, in the house of a friend, which was reduced to ashes in the great fire of June, 1795. All these plates were destroyed; and with them perished all desire, all heart, for the completion of the unfinished volume.

"An opportunity did, indeed, shortly present itself for the publication of its contents, though not in Germany. In England his reputation was so high, that almost every body who heard my name accosted me with cordial inquiries for my father, and an acquaintance with his works was so widely diffused through the medium of Heron's extracts, that I met with them in the houses of several country people, and a friend of mine found them even in the island of Mull. Very eager inquiries were now addressed to him from that country, whether he would not publish the deficient volume there, and in the English language. This he declined, partly because he anticipated more difficulties from the sending over a copy of the manuscript for me to translate than really existed; but partly, also, because with all his attachment to England, he thought it unbecoming and wrong to suffer the conclusion of a work which might be considered as the property of the Danish government, to whom it owed its very existence, to appear in any other country than Denmark, or in any other language than German. At subsequent periods the same proposal was renewed to me, first in 1802; and when I saw that all hope of his giving a German edition was at an end, and at the same time that he was fully satisfied of the correctness of his geographical and astronomical observations, I earnestly entreated him to send me the MS. and to permit it to be translated. My intention was to append to it a translation of the history of Zebid, which he sent to Copenhagen, together with other MSS., and which is still to be found in the royal library there. It contains a circumstantial history of Yemen, from the time of its separation from the caliphate through the whole of the middle ages. I also intended to extract all that was not botanical from Forskaal's cruelly neglected works, and to annex these, together with a general map of Arabia. My father persisted in his refusal, of which he, however, afterwards repented. During the campaign in East Prussia, Lord Hutchinson, one of his most zealous admirers, made the same proposal to him through me, and offered to negotiate the affair on the most advantageous terms, according to the relations generally subsisting in England between author and publisher. But at that time I had no longer the power of making any historical additions to the description of Arabia; the sending the manuscripts to me, even after the peace of Tilsit, was very doubtful; and the conveying the translation to England, during the tyrannical prohibition of all intercourse, attended with great danger."

In Zach's monthly correspondence Niebuhr found some remarks and criticisms on Mayer's system of longitudinal observations, which he little expected, having scarcely any means of observing the developement and growth of science in the remote corner of the world where he lived. Agreeably surprised, he immediately communicated to M. von

Zach the existence of his own observations, the earliest which had been attempted upon the system in question, and offered to send them to him. The readers of Zach's journal know how this offer was received by M. von Zach and M. von Bürg, and what judgment they pronounced on his determination of places, after they had been calculated according to Bürg's perfected tables: this treasure of the geography of Asia is now on record in the above-mentioned correspondence.

The tranquillizing assurance that he had not laboured in vain, and that he was at length understood and appreciated, was a balm and a cordial to his old age. In 1802 he was further gratified by the distinction conferred upon him in being appointed foreign member of the Institute of France; for although his native dislike to that country had been increased by the tyrannical domination which now pressed so heavily on the continent, he nevertheless acknowledged that, in the sciences to which he had devoted himself, no society could then, for dignity and splendour, be compared with the National Institute.

Another agreeable incident which marked this period was, that an addition to his salary, proportioned to the general rise in prices since his residence in Holstein, was made by the voluntary favour of the present King of Denmark, then Crown Prince. From the time this prince took the reins of government, Niebuhr received marks of distinguished favour from him, without any request or application on his part. Although, perhaps, he owed this principally to his fame as a traveller and a man of science, he had deserved it no less as a public functionary. The business of his office, which consisted chiefly in the collection of taxes and in public accounts, was not indeed very agreeable to him, nor suited to a man of his turn; he however executed it with unwearied diligence and fidelity. The mildness and consideration with which he performed his duty, often at the risk or with the certainty of personal loss, at a time when the growing burthen of the taxes was so great as to convert the industrious peasant into a dilatory payer, won him the gratitude of the people; while the exactness and extraordinary intelligence he displayed in the discharge of his duties, ensured him the respect and applause of the government. Among the concerns committed to his care was one which was peculiarly attractive to him, and which opened a wide field for improvement. This was the superintendence of the out-dikes. He reflected much on the means of promoting and accelerating their increase, especially by draining the *priele* and *sprante* (as the natives call the small channels which, at ebb-tide, are left flowing through the bed of the river), and was unremittingly engaged in drawing up notices and reports with the hope of obtaining approbation and money for the prosecution of the work, the cost of which could be but slowly replaced. In his frequent visits to these lands he was led particularly to observe the very remarkable phenomena exhibited by the successive layers, so to speak, of vegetation, growing one out of another on the gradually increasing additions to the soil; from the plants of the *salsolæ* tribe which grow in the mud deposited by the ebb-tide, to the fine grasses of the mature crust or soil. These had been hitherto unobserved, and if they are now known to naturalists, it is probably through his repeated descriptions of appearances which had been noticed only by the shepherds and husbandmen of these extensive pastures.

From the earliest time of his appointment to his office, up to the year 1802, the duties he had to discharge were nearly unaltered; from that time they increased in proportion as the necessitous state of the public finances gave occasion to an increase of the public burdens. The first of the many fresh taxes which succeeded were the land and usufruct taxes, in the imposition of which the old registers of the country were entirely disregarded, and a new valuation became necessary. In the commission appointed for the district, Niebuhr, from his official knowledge and connections, and from his personal zeal, was the most active, indeed almost the only working member. In order to appreciate what a task this was, we must first conceive a district containing 24,000 inhabitants, all agricultural; the whole land divided into small ownerships, which were smaller in proportion as the marsh was more fertile. Niebuhr revised the valuation himself, and deliberated and decided on the appeals. In his 71st and 72nd years he worked through a great part of the night, nor did his indefatigable zeal relax even when his sight began to fail. The

reader will remember how his eyes suffered from drawing at Persepolis. They afterwards sustained a sudden and still more fatal shock from his negligence in not using coloured glass during a solar observation. Egypt and the deserts had also left permanent effects upon them. The consequences of this night-work were irremediable and fatal. In a short time he could no longer see to read, and for writing he required an extraordinary quantity of light, and even then the lines were often run into one another. This blindness, the progress of which he clearly perceived was not to be arrested, made him very anxious, the more, as it threatened to compel him to resign his employment. This he was happily enabled to avoid.

His wife, after many years suffering from asthma, which ended in water in the chest, died in December, 1807. His daughter and her widowed sister, who had lived with her for twelve years, freed from the constant care her illness had demanded, could now devote themselves wholly to rendering him the assistance of which he stood so much in need. His daughter did not confine herself to administering to his bodily wants and infirmities, she did that part of his business which he was no longer able to do. This, however, was not sufficient, as his sight became worse and worse, and what he wrote with the utmost care was nearly illegible.

His family and friends regarded it as one of the best rewards of his honourable and useful life, that, at the close of it, he found a friend who undertook the discharge of the duties of his office with all the devotion and attachment of a son. Gloyer, who became his successor, took a deep and lively interest in statistics, to which we owe his valuable and instructive fragments on India, and on the state of taxation in that country. He was introduced to Niebuhr, who found his society so delightful, that as he was not engaged in any employment, he invited him into his house as an assistant. Gloyer complied with his wishes, and the government acceded to Niebuhr's request that his friend should be officially recognised in that capacity. Gloyer shared the labours of the office; and the tranquillity with which Niebuhr could confide the execution and credit of his post to such a friend and such a daughter were the best rewards for the fidelity with which he had discharged its duties. He felt it to be so. He did not, however, withdraw his mind from his business; he had kept the thread of it unbroken, though he had so long been blind; everything was read aloud to him and discussed with him. Gloyer's conversation and daily intercourse revived to his mind's eye many a faded or vanished picture of the east, and the books which this invaluable friend read aloud to him, and the circumstances he related, put him in possession of the works and statements of more recent travellers. This was without comparison the highest enjoyment of which he was susceptible. "When I related to him," says his son, "the descriptions of any traveller newly returned from the east, or gave him in my letters any accounts of travels not known on the continent, his whole being seemed reanimated, and he dictated answers which showed that his mental vision was vivid and powerful as ever. It was still more remarkable that these new facts imprinted themselves on his mind with all the depth and sharpness with which objects are stamped on a youthful memory, and so remained up to the time of his death. He combined them with what he had himself observed and experienced.

"I was deprived of the happiness of contributing to his comfort or enjoyment by any other means than such communications, which the total prohibition of intercourse between England and the continent daily rendered more rare and difficult of access.

"Among the circumstances which contributed to gladden his old age was the constant intercourse he enjoyed with a family brought up in Meldorf, and nearly related to him, the members of which were like children and grandchildren to him. His friendship with the Treasurer of the district *(Landespfennigmeister)*, Piehl, who, in the management of the concerns of the province, exhibited the rarest combination of sagacity and aptitude, and whose whole character was the perfect model of the citizen of a republic, became more close and intimate in proportion as both advanced in age. A visit from this excellent friend when he returned from one of his journeys into the country, or a visit to his house, where every thing bespoke his active mind and beneficent disposition, were festivals. Piehl was indeed a most remarkable man; a history of his life and of his administration of the finances of the province, into the frightful chaos of

which he introduced order; actively and prudently, so far as was possible to human efforts, taking advantage of good times, and correcting the remaining influence of bad ones;—lightening the terrible pressure on the people by the sacrifice of his own property, and the offer of his own credit;—a history of this noble example of public service, for the display of which a free agricultural community managing its own affairs affords the sole field, would be a well-deserved monument to his honour; an edifying and instructive document to all placed in the same circumstances, and to all who entertain sincere and conscientious doubts as to the blessings of a free and democratic government.

"These various mental pleasures and consolations became so much the more necessary from his increasing bodily infirmities. He was of a phlegmatic, robust, and plethoric constitution, to which, from the habit of many years, bleeding had become indispensable. Unfortunately, he conceived the idea that his great age rendered it necessary to discontinue this; nor could any warnings or remonstrances induce him to resort to it again, till at length attacks of dizziness, sudden deafness and spitting of blood showed the danger to be imminent. These symptoms, which began about the time of his wife's death, continued to return with more or less violence every spring and autumn; till, in October, 1813, he was attacked by a frightful bleeding at the nose which, however, his robust temperament enabled him to rise above.

"Sated, though not disgusted, with life, he frequently in the course of this year expressed his willingness to rejoin his wife, whenever God's good time were; yet he wished to live to see the destinies of the world decided, and once again to embrace his absent children. His wishes were granted, though he was first compelled to behold an invading army in Holstein. The distress and terror which such an event always brings in its train, did not overcome his joy at the deliverance of Europe and the glorious triumphs of Germany and her allies.

"The camp in Ditmarschen, on the side of a road, whither only light troops were sent, brought upon the country all the terror of an ungoverned soldiery. Meldorf was also in a state of great alarm from a troop of Mecklenburghers, who were used by a rapacious commissary as means of extorting contributions by threats of fire and pillage. To protect Niebuhr against these atrocities, Colonel Von Clausewitz, then of the German Legion, and now chief of the staff of General Count Gneisenau, sent him a guard.

"One of the symptoms of increasing infirmity and a consequence of the sort of attacks already mentioned, was a weakness in one leg, which occasioned him many falls. It was, however, unattended with any important consequences till an unlucky fall, in March, 1814, which injured his right thigh and caused a permanent lameness in it. From that time he was never able to set his foot to the ground; nor could he move without assistance or without pain; he could only be removed from his bed in the afternoon on a wheeled chair. He clung long to the hope of recovery; but even the gradual decline and extinction of this hope could not abate his truly saint-like gentleness and resignation. Gratitude to Gloyer, who helped to carry and move him about, and whose solicitude to occupy and amuse him was unwearied and inventive;—to his daughter, who devoted herself entirely to him;—to his sister-in-law, and to all who showed him any kindness, rendered him happy even amid pain and infirmity.

"It was thus we found him," says his son, "in the autumn of 1814, and his appearance was calculated to leave a delightful picture in the mind. All his features, as well as his extinguished eyes, wore the expression of the extreme and exhausted old age of an extraordinarily robust nature;—it was impossible to behold a more venerable sight. So venerable was it, that a Cosack who entered, an unbidden guest, into the chamber where he sat with his silver locks uncovered, was so struck with it, that he manifested the greatest reverence for him, and a sincere and cordial interest for the whole household. His sweetness of temper was unalterable, though he often expressed his desire to go to his final home, since all which he had desired to live for had been accomplished.

"A numerous, and as yet unbroken, family circle was assembled around him, and every day in which he was not assailed by some peculiar indisposition, he conversed with cheerfulness and cordial enjoyment on the happy change which had taken place in public affairs. We found it very delightful to engage

him in continued recitals of his travels, which he now related with peculiar fulness and vivacity. In this manner he once spoke much, and in great detail, of Persepolis, and described the walls on which he had found the inscriptions and bas-reliefs, exactly as one would describe those of a building visited within a few days, and familiarly known. We could not conceal our astonishment. He replied, that as he lay in bed, all visible objects shut out, the pictures of what he had beheld in the East continually floated before his mind's eye, so that it was no wonder he could speak of them as if he had seen them yesterday. With like vividness was the deep intense sky of Asia, with its brilliant and twinkling host of stars which he had so often gazed at by night, or its lofty vault of blue by day, reflected, in the hours of stillness and darkness, on his inmost soul;—and this was his greatest enjoyment. In the beginning of winter he had another bleeding at the nose, so violent, that the by-standers expected his death—but this also he withstood.

"About the end of April, 1815, the long existing obstruction in his chest grew much worse; but his friendly physician alleviated the symptoms which to those around him appeared rather painful than dangerous. Towards evening, on the 26th of April, 1815, he was read to as usual, and asked questions which showed perfect apprehension and intelligence: he then sunk into a slumber, and departed without a struggle."

A concourse of people from all parts of the country attended his body to the grave. It was the opinion of all, that no individual had ever been so universally regretted. The funeral was solemnized with all the honours which respect and affection can pay. He had attained the age of eighty-two.

He was counsellor of state of Denmark; knight of the Dannebrog, of the fourth class; secretary (landschreiber) to the district of South Ditmarschen; member of the society of sciences of Göttingen; of the Swedish and Norwegian societies; and of the society for the investigation of natural science; and foreign member of the National Institute of France.

In stature he was rather under the middle size, of a very robust and sturdy make; up to his fortieth year, thin, but later in life, thick set and fat. There is only one engraving of him extant,—a bad copy of a good picture painted in his youth. It is prefixed to a volume of the *Allgemeinen Deutschen Bibliothek*. His person and carriage, the sturdy looking head, the powerful neck, and his whole gesture, gave him a completely oriental air. When seen from behind in an eastern dress, especially when walking and in conversation, gesticulating with his hands, no man could have distinguished him among a party of Arabs. I have often been struck with this when I have looked after Moors of the Barbary states in the streets..

He was extremely frugal: economy had become a habit with him in early life. As a peasant lad he drank nothing but water and milk; and at a later period he deviated from this simple diet only in compliance with the customs of others, with which he every where made it a rule to conform, and he then drank an extremely small quantity of wine. He had no favourite dishes but the peasant fare of his native land.

He was, and remained through his whole life, *a true and genuine peasant;* with all the virtues, and with the little failings, of the class from which he sprang. He was, unquestionably, somewhat obstinate; and it was very difficult to reason him out of an idea he had once strongly taken up: he continually reverted to it. Equally strong and inveterate were his prejudices for and against men. This pertinacity, however, it was, which gave him strength during the greater part of his life to follow the path he had chosen, through every difficulty and danger. His moral character was spotless, and his manners extremely pure and severe. In every circumstance and relation of life, he was unpresuming and disinterested.

The bent of his mind was entirely for the observation and investigation of sensible objects: abstraction and speculation were foreign to his genius, which could lay hold of nothing but the concrete. With regard to books, he was most rigorous as to the truth of the statements they contained; that form of conveying them pleased him the best which was the simplest. Poetry, except Homer, in Voss's translation, Göethe's Hermann and Dorothea, and songs for music, was quite uncongenial with his tastes. Fielding and Smollett's novels he loved; he had read no others. Architecture interested him; but to the arts of painting and sculpture he was indifferent: music he loved.

He lived in observation and percep-

tion. A friend of his own age, who took a short journey with him when both were advanced in life, silently remarked, and afterwards related with great delight, how he had found something to observe and to investigate in every field and every village they passed through. In his sixty-eighth year he visited this same friend in his then residence, where he had never before been. The morning after his arrival he let himself out at the house-door at four o'clock in the morning, and before breakfast had wandered through and around the whole town, and had so perfect and exact a picture of it in his mind, that every house and every building he inquired about was instantly recognised and named from his description.

This exclusive turn of his mind rendered him indifferent to subjects of mere speculation. He advanced towards the unknown regions with the full tranquillity of a conscience "void of all offence" and of all blemish. He relied for the protection of himself and those dear to him on that overruling Providence, of which, in the course of his own life, he had had striking experience. "It is extraordinary," says his son, "that this man, so remarkably devoid of imagination, so exempt from illusion, waked us on the night in which his brother died, though he was at such a distance that he knew not even of his illness, and told us that his brother was dead. What had appeared to him, waking or dreaming, he never told us."

As he had conceived a very high and extensive idea of the duties which devolved upon him on his travels, he never lost the remembrance of the designs he had relinquished, in compliance with the wishes of others, or in consequence of obstacles. He reproached himself for these omissions with a severity which we never could convince him was exaggerated and unjust. In his old age, these self-tormentings assumed a character which gave us great pain. Acknowledgments of his merits by competent and experienced judges, such as Reiske, Silvestre de Sacy, Rennell, &c. gave him the sincerest pleasure: to external honours or homage addressed to his vanity, he was quite inaccessible. Nobility, which was offered him by the minister Guldberg, he refused. The title which he was compelled by custom to assume, as officer of engineers in the Danish army, led a relation of his to ask him, "If he had caused himself to be ennobled?"—"No," replied he, "I would not offer my family such an affront."

He founded, and bequeathed to his family, a more enduring nobility. To this time no traveller returns from the east without wonder and gratitude towards such an instructor and guide, the first and best of all describers of the east. Not one, of all who have hitherto followed, has equalled him; and it is yet doubtful whether he will ever find a successor, who will complete what he has left unfinished of the description of Arabia, and worthily occupy a place by his side.

BIOT, Jean Baptiste

# LIFE OF SIR ISAAC NEWTON.

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The following life is substantially a translation from that in the "Biographie Universelle," by M. Biot, the very learned French mathematician and natural philosopher; and to the kindness of this distinguished individual we feel deeply indebted, for allowing us to present this number to our readers. Those alterations only have been made, which we considered might render the treatise more adapted for the objects which the Society has in view.

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Isaac Newton was born at Woolsthorpe, in Lincolnshire, on the 25th December, 1642 (O. S.) the year in which Galileo died. At his birth he was so small and weak that his life was despaired of. At the death of his father, which took place while he was yet an infant, the manor of Woolsthorpe, of which his family had been in possession several years, became his heritage. In a short time his mother married again; but this new alliance did not interfere with the performance of her duties towards her son. She sent him, at an early age, to the school of his native village, and afterwards, on attaining his twelfth year, to the neighbouring town of Grantham, that he might be instructed in the classics. Her intention, however, was not to make her son a mere scholar, but to give him those first principles of education which were considered necessary for every gentleman, and to render him able to manage his own estate. After a short period, therefore, she recalled him to Woolsthorpe, and began to employ him in domestic occupations. For these he soon showed himself neither fitted nor inclined. Already, during his residence at Grantham, Newton, though still a child, had made himself remarkable by a decided taste for various philosophical and mechanical inventions. He was boarded in the house of an apothecary, named Clarke, where, caring but little for the society of other children, he provided himself with a collection of saws, hammers, and other instruments, adapted to his size; these he employed with such skill and intelligence, that he was able to construct models of many kinds of machinery; he also made hour-glasses, acting by the descent of water, which marked the time with extraordinary accuracy. A new windmill, of peculiar construction, having been erected in the vicinity of Grantham, Newton manifested a strong desire to discover the secret of its mechanism; and he accordingly went so often to watch the workmen employed in erecting it, that he was at length able to construct a model, which also turned with the wind, and worked as well as the mill itself; but with this difference, that he had added a *mouse* in the interior, which he called the *miller*, because it directed the mill, and ate up the flour, as a real miller might do. A certain acquaintance with drawing was necessary in these operations; to this art, though without a master, he successfully applied himself. The walls of his closet were soon covered with designs of all sorts, either copied from others, or taken from nature. These mechanical pursuits, which already implied considerable powers of invention and observation, occupied his attention to such a degree, that for them he neglected his studies in language; and, unless excited by particular circumstances, he ordinarily allowed himself to be surpassed by children of very inferior mental capacity. Having however, on some occasion, been surpassed by one of his class fellows, he determined to prevent the recurrence of such a mortification, and very shortly succeeded in placing himself at the head of them all.

It was after Newton had for several years cherished and, in part, unfolded so marked a disposition of mind, that his mother, having taken him home, wished to employ him in the affairs of her farm and household. The reader may easily judge that he had little inclination for such pursuits. More than once

he was sent by his mother on market-days to Grantham, to sell corn and other articles of farming produce, and desired to purchase the provisions required for the family; but as he was still very young, a confidential servant was sent with him to teach him how to market. On these occasions, however, Newton, immediately after riding into the town, allowed his attendant to perform the business for which he was sent, while he himself retired to the house of the apothecary where he had formerly lodged, and employed his time in reading some old book, till the hour of return arrived. At other times he did not even proceed so far as the town, but stopping on the road, occupied himself in study, under the shelter of a hedge, till the servant came back. With such ardent desire for mental improvement, we may easily conceive that his repugnance to rural occupations must have been extreme; as soon as he could escape from them, his happiness consisted in sitting under some tree, either reading, or modelling in wood, with his knife, various machines that he had seen. To this day is shewn, at Woolsthorpe, a sun-dial, constructed by him on the wall of the house in which he lived. It fronts the garden, and is at the height to which a child can reach. This irresistible passion, which urged young Newton to the study of science, at last overcame the obstacles which the habits or the prudence of his mother had thrown in his way. One of his uncles having one day found him under a hedge, with a book in his hand, entirely absorbed in meditation, took it from him, and discovered that he was working a mathematical problem. Struck with finding so serious and decided a disposition in so young a person, he urged Newton's mother no longer to thwart him, but to send him once more to pursue his studies at Grantham.*

There he remained till he reached his eighteenth year, when he removed to Cambridge, and was entered at Trinity-College, in 1660. Since the beginning of the seventeenth century, a taste for the cultivation of mathematical knowledge had shown itself among the members of that University. The elements of algebra and geometry generally formed a part of the system of education, and Newton had the good fortune to find Dr. Barrow, professor; a man who, in addition to the merit of being one of the greatest mathematicians of his age, joined that of being the kindest instructor as well as the most zealous protector of the young genius growing up under his care.

Newton, in order to prepare himself for the public lessons, privately read the text books in advance, the better to follow the commentaries of the lecturer. These books were, Bishop Sanderson's Logic,* and Kepler's Treatise on Optics, from which it is evident the young learner must have made considerable progress in the elements of geometry when studying at Grantham. After Newton went to Cambridge, the process of the unfolding of his intellect, a subject so interesting in the study of the human mind, fortunately remains to us either described by himself or established in literary monuments, by which we are enabled accurately to trace its progress.

At this epoch, Descartes bore sway both in speculative and in natural philosophy. The authority of the metaphysical systems of his daring and fertile mind having succeeded to the empire which those of Aristotle had previously exercised, caused his method and his works to be adopted also in mathematics. Hence the geometry of Descartes was one of the first books that Newton read at Cambridge.

After Newton's persevering efforts, when reading alone, to make himself master of the elements of this science, explained so unconnectedly and imperfectly by other authors, he must have felt a lively pleasure on entering on the wide career that the French analyst was the first to open, and in which, having shown the connexion between algebraical equations and geometry, he discovers to us the use of that relation in solving, almost at sight, problems which, up to that time, had foiled the efforts of all the ancient and modern mathematicians. It is singular, however, that Newton, in his writings, has never mentioned Descartes favourably; and, on more than one occasion, has treated him with injustice.† He next proceeded, when

* These details of the infancy of Newton are taken chiefly from "*Collections for the History of the Town and Soke of Grantham, containing authentic Memoirs of Sir Isaac Newton, &c.* by *Edmund Turner*, (London, 1806.)" And from the *Eloge on Newton*, written by Fontenelle.

* The title is *Logicæ artis Compendium, auctore Robert Sanderson. Oxon.* 8*vo*.

† Particularly in his Optics, where he attributes the discovery of the true theory of the rainbow to Antonius de Dominis, Archbishop of Spalatro, leaving to Descartes only the merit of having "*mended* the ex-

about twenty-one years old, to read the works of Wallis, and appears to have taken peculiar delight in studying the remarkable treatise of this analyst, entitled *Arithmetica infinitorum.* It was his custom, when reading, to note down what appeared to him capable of being improved; and, by following up the ideas of Wallis, he was led to many important discoveries: for instance, Wallis had given the quadrature of curves, whose ordinates are expressed by any integral and positive power of $(1-x^2)$; and had observed, that if, between the areas so calculated, we could interpolate the areas of other curves, the ordinates of which constituted, with the former ordinates, a geometrical progression, the area of the curve, whose ordinate was a mean proportional between 1 and $(1-x^2)$ would express a circular surface, in terms of the square of its radius. In order to effect this interpolation, Newton began to seek, empirically, the arithmetical law of the co-efficients of the series already obtained.* Having found it, he rendered it more general, by expressing it algebraically. He then perceived that this interpolation gave him the expression in series of radical quantities, composed of several terms; but, not blindly trusting to the induction that had conducted him to this important result, he directly verified it by multiplying each series by itself the number of times required by the index of the root, and he found, in fact, that this multiplication re-produced exactly the quantity from which it had been deduced. When he had thus ascertained that this form of series really gave the development of radical quantities, he was obviously led to consider that they might be obtained still more directly, by applying to the proposed quantities the process used in arithmetic for extracting roots. This attempt perfectly succeeded, and again gave the same series, which he had previously discovered by indirect means; but it made them depend on a much more general method, since it permitted him to express, analytically, any powers whatever of polynomials, their quotients, and their roots; by operating upon and considering these quantities as the developments of powers corresponding to integral, negative, or fractional exponents. It is, in fact, in the generality and in the uniformity given to these developments in which the discovery of Newton really consists: for Wallis had remarked before him, with regard to monomial quantities, the analogy of quotients and roots, with integral powers, expressed according to the notation of Descartes; nay, more, Pascal had given a rule for forming, directly, any term of an expanded power of a binomial, the exponent being an integer. But whatever might be the merit of these observations, they were incomplete, and wanted generality, from not being expressed in an algebraical form. In fact, this step made by Newton was indispensable for discovering the development of functions into infinite series. Thus was found out the celebrated formula of such constant use in modern analysis, known by the name of the *Binomial Theorem of Newton;* and not only did he discover it, but he further perceived that there is scarcely any analytical research in which the use of it is not necessary, or at least possible. He immediately made a great number of the most important of these applications, solving, in this way, by series, with unexampled facility and exactness, questions which, up to that time, had not even been attempted, or of which solutions had been obtained only when the real difficulties of the case were removed by particular limitations. It was thus that he obtained the quadrature of the hyperbola and of many other curves, the numerical values of which he amused himself in computing to as many decimal places nearly as had previously been employed in the case of the circle alone: such pleasure did he take in observing the singular effect of these new analytical expressions, which, when capable of being determined exactly, stopped after a certain number of terms; and, in the opposite case, extended themselves indefinitely, while approximating more and more to the truth. Nor did he confine his application of these formulæ to the

plication of the exterior bow;" and yet every impartial reader, who refers to the original works, will see that the theory of Descartes is exact and complete, either as to the cause of *the bow*, its formation, or its size, and that he was only unacquainted with the cause of the *different colours;* and even, notwithstanding his ignorance relative to this part of the phenomenon, Descartes, with great sagacity, refers it to another experimental fact, by assimilating it to the colours formed by prisms. It is this formation of colours that Newton has so completely explained by the unequal refrangibility of the rays of light; but all the rest of the explanation is due to Descartes. The book of Dominis contains absolutely nothing but explications entirely vague, without any calculation or real result.

* These details are mentioned by Newton himself, in a letter sent through Oldenburg to Leibnitz, dated October 24, 1676. It is No. LV. in the *Commercium Epistolicum*, published by order of the Royal Society of London.

areas of curves and their rectification, but extended it to the surfaces of solids, to the determination of their contents, and the situation of their centres of gravity. To understand how this method of reducing into series could conduct him to such results, we must recollect that, in 1665, Wallis, in his *Arithmetica infinitorum*, had shown that the area of all curves may be found whose ordinate is expressed by any integral power of the abscissa; and he had given the expression for this area in terms of the ordinate. Now, by reducing into series the more complicated functions of the abscissa which represent the ordinates, Newton changed them into a series of monomial terms, to each of which he was able to apply the rule of Wallis. He thus obtained as many portions of the whole area as there were terms, and by their addition obtained the total. But the far more extensive, and, in some respects, unlimited applications that Newton made of this rule, depended on a general principle which he had made out, and which consisted in the determining, from the manner in which quantities gradually increase, what are the values to which they ultimately arrive. To effect this, Newton regards them not as the aggregates of small homogeneous parts, but as the results of continued motion; so that, according to this mode of conception, lines are described by the movement of points, surfaces by that of lines, solids by that of surfaces, and angles by the rotation of their sides. Again—considering that the quantities so formed are greater or smaller in equal times, according as the velocity with which they are developed is more or less rapid, he endeavours to determine their ultimate values from the expression for these velocities, which he calls *Fluxions*, naming the quantities themselves *Fluents*. In fact, when any given curve, surface, or solid is generated in this manner, the different elements which either compose or belong to it, such as the ordinates, the abscissæ, the lengths of the arcs, the solid contents, the inclinations of the tangent planes, and of the tangents, all vary differently and unequally, but nevertheless according to a regular law depending on the equation of the curve, surface, or solid under consideration.

Hence Newton was able to deduce from this equation the fluxions of all these elements, in terms of any one of the variables, and of the fluxion of this variable, considered as indeterminate; then, by expanding into series, he transformed the expression, so obtained, into finite, or infinite series of monomial terms, to which Wallis's rule became applicable: thus, by applying it successively to each, and taking the sum of the results, he obtained the ultimate value, i. e. *the fluent* of the element he had been considering. It is in this that the method of fluxions consists, of which Newton from that time laid the foundation; and which, eleven years later, Leibnitz again discovered, and presented to the world in a different form, that, namely, of the modern *Differential calculus*. It were impossible to enumerate the various discoveries in mathematical analysis, and in natural philosophy, that this calculus has given rise to; it is sufficient to remark, that there is scarcely a question of the least difficulty in pure or mixed mathematics that does not depend on it, or which could be solved without its aid. Newton made all these analytical discoveries before the year 1665, that is, before completing his twenty-third year. He collected and arranged them in a manuscript, entitled "*Analysis per æquationes numero terminorum infinitas.*" He did not, however, publish, or even communicate it to any one, partly, perhaps, from a backwardness to attain sudden notoriety, though more probably from his having already conceived the idea of applying this calculus to the determination of the laws of natural phenomena, anticipating that the analytical methods which he had discovered would be to him instruments for working out the most important results. It is at least certain, that, satisfied with the possession of this treasure, he kept it in reserve, and turned his attention more closely towards objects of natural philosophy. At this time (1665), he quitted Cambridge to avoid the plague, and retired to Woolsthorpe. In this retreat he was able to abandon himself, without interruption, to that philosophical meditation which appears to have been essential to his happiness.

The following anecdote is related by Pemberton, the contemporary and friend of Newton.—Voltaire, in his 'Elements of Philosophy,' says that Mrs. Conduit, Newton's niece, attested the fact.

One day, as he was sitting under an apple-tree, (which is still shown) an apple fell before him; and this incident

awakening, perhaps, in his mind, the ideas of uniform and accelerated motion, which he had been employing in his method of fluxions, induced him to reflect on the nature of that remarkable power which urges all bodies to the centre of the earth; which precipitates them towards it with a continually accelerated velocity; and which continues to act without any sensible diminution at the tops of the highest towers, and on the summits of the loftiest mountains. A new idea darted across his mind. "Why," he asked himself, "may not this power extend to the moon, and then what more would be necessary to retain her in her orbit about the earth?" This was but a conjecture; and yet what boldness of thought did it not require to form and deduce it from so trifling an accident! Newton, we may well imagine, applied himself with all his energy to ascertain the truth of this hypothesis. He considered, that if the moon were really retained about the earth by terrestrial gravity, the planets, which move round the sun, ought similarly to be retained in their orbits by their gravity towards that body.* Now, if such a force exists, its constancy or variability, as well as its energy at different distances from the centre, ought to manifest itself in the different velocity of the motion in the orbit; and consequently, its law ought to be deducible from a comparison of these motions. Now, in fact, a remarkable relation does exist between them, which Kepler had previously found out by observation, namely, that the squares of the times of revolution of the different planets are proportional to the cubes of their distances from the sun. Setting out with this law, Newton found, by calculation, that the force of solar gravity decreases proportionally to the square of the distance; and it is to be observed that he could not have arrived at this result without having discovered the means of determining from the velocity of a body in its orbit, and the radius of the orbit supposed to be circular, the effort with which it tends to recede from the centre; because it is this effort that determines the intensity of the gravity, (to which, in fact, the effort is equal.) It is precisely on this reasoning, that the beautiful theorems on centrifugal force, published six years afterwards by Huygens, are founded; whence it is plain that Newton himself must necessarily have been acquainted with these very theorems. Having thus determined the law of the gravity of the planets towards the sun, he forthwith endeavoured to apply it to the moon; that is to say, to determine the velocity of her movement round the earth, by means of her distance as determined by astronomers, and the intensity of gravity as shown by the fall of bodies at the earth's surface. To make this calculation, it is necessary to know *exactly* the distance from the surface to the centre of the earth, expressed in parts of the same measure that is used in marking the spaces described, in a given time, by falling bodies at the earth's surface; for their velocity is the first term of comparison that determines the intensity of gravity at this distance from the centre, which we apply afterwards at the distance of the moon by diminishing it proportionally to the square of her distance. It then only remains to be seen, if gravity, when thus diminished, has precisely the degree of energy necessary to counteract the centrifugal force of the moon, caused by the observed motion in her orbit. Unhappily, at this time, there existed no correct measure of the earth's dimensions. Such as were to be met with, had been made only for nautical purposes, and were extremely imperfect. Newton, having no other resource but to employ them, found that they gave for the force that retains the moon in her orbit, a value greater by $\frac{1}{6}$ than that which results from her *observed* circular velocity. This difference, which would, doubtless, to any other person, have appeared very small, seemed, to his cautious mind, a proof sufficiently decisive against the bold conjecture which he had formed. He imagined that some unknown cause, analogous, perhaps, to the vortices of Descartes,* modified, in the case of the moon, the general law of gravity indicated by the movement of the planets. He did not, however, on this account, wholly

* Newton afterwards shewed the truth of this result, by deducing it from a law observed by Kepler, in the movement of all the planets, which consists in the description of areas proportional to the times, by the radius vector drawn from each planet to the sun; but he did not know how to make use of this law till he had discovered the means of calculating the motion in an elliptic orbit; that is, about the end of the year 1679.

* Vide Whiston's *Memoirs of Himself*, page 23, &c.

abandon his leading notion, but, in conformity with the character of his contemplative mind, he resolved not yet to divulge it, but to wait until study and reflection should reveal to him the unknown cause which modified a law indicated by such strong analogies. This took place in 1665-6. During the latter year, the danger of the plague having ceased, he returned to Cambridge, but he did not disclose his secret to any one, not even to his instructor, Dr. Barrow. It was not till two years afterwards, 1668, that Newton communicated to the latter, who was then engaged in publishing his lectures on Optics, certain theorems relating to the optical properties of curved surfaces, of which Barrow makes very honourable mention in his preface. Newton had now become a colleague of his former tutor, having been admitted master of arts the preceding year. At length in the same year (1668) an occurrence in the scientific world compelled him to declare himself. Mercator* printed and published, towards the end of this year, a book called *Logarithmotechnia*, in which he had succeeded in obtaining the area of the hyperbola referred to its asymptotes, by expanding its ordinate into an infinite series; this he did *by means of common division*, as Wallis had done in the case of fractions of the form $\frac{1}{1-x}$: then, considering each term of this series separately, as representing a particular ordinate, he applied to it Wallis's method for curves, whose ordinates are expressed by a single term, and the sum of the partial areas so obtained, gave him the value of the whole area. This was the *first* example *given to the world* of obtaining the quadrature of a curve by expanding its ordinate into an infinite series. And it was also the main secret in the general method which Newton had invented for all problems of this nature. The novelty of the invention caused it to be received with general applause. Collins, a gentleman well known to science and philosophy at that time, hastened to send Mercator's book to his friend Barrow, who communicated it to Newton. The latter had no sooner glanced over it, than recognizing his own fundamental idea, he immediately went home, to find the manuscript; in which he had explained his own method, and presented it to Barrow; this was the treatise *Analysis per æquationes numero terminorum infinitas.* Barrow was struck with astonishment at seeing so rich a collection of analytical discoveries of far greater importance than the particular one which then excited such general admiration. Perhaps, too, he must have been still more surprised at their young author having been able to keep them so profoundly secret. He immediately wrote about them to Collins, who, in return, entreated Barrow to procure for him the sight of so precious a manuscript. Collins obtained his request, and happily, before returning the work, took a copy of it, which being found after his death, among his papers, and published in 1711, has determined beyond dispute, by the date which it bore, at what period Newton made the memorable discovery of expansion by series, and of the method of fluxions. It would have been natural to suppose that an interference with his own discoveries would at last have induced Newton to publish his methods; but he preferred still to keep them secret. "I suspected," says he, "that Mercator must have known the extraction of roots, as well as the reduction of fractions into series by division, or at least, that others, having learnt to employ division for this purpose, would discover the rest before I myself should be old enough to appear before the public, and, therefore, I began henceforward to look upon such researches with less interest."*

It were difficult to explain this reserve and indifference by the feelings of extreme modesty alone; but we may come near the truth by considering what were the habits of Newton, and by figuring to ourselves the new and extraordinary allurements of another discovery which he had just made, and which he already enjoyed in secret; for in general, the effort of thinking was with him so strong, that it entirely abstracted his attention from other matters, and confined him exclusively to one object. Thus we know that he never was occupied at the same time with two different scientific investigations. And we find,† even in the most beautiful of his works, the simple, yet expressive avowal of the disgust with which his most curious researches had always finally inspired him, from his ideas being

* Born in Holstein: he passed the greater part of his life in England.

* Com. Epist. LVI.

† At the end of the Optics.

continually, and for a long time, directed to the same object. This might, perhaps, also have in part been caused by a discouraging conviction, that he would seldom be understood and followed in the chain of his reasoning; since others, in order to do so, must be as deeply immersed in the subject and as abstracted from other matters as himself. Be this as it may, when Mercator's work appeared, a new series of discoveries of a totally different nature had taken hold of Newton's thoughts.

In the course of 1666, he had accidentally been led to make some observations on the refraction of light through prisms. These experiments, which he had at first tried merely from amusement, or curiosity, soon offered to him most important results. They led him to conclude that light, as it emanates from radiating bodies, such as the sun, for instance, is not a simple and homogeneous substance, but that it is composed of a number of rays endowed with unequal refrangibility, and possessing different colouring properties. The inequality of the refraction undergone by these rays in the same body, when they enter at the same angle of incidence, enabled him to separate them; and thus, having them unmixed and pure, he was able to study their individual properties. But the breaking out of the plague, which in this year compelled him to take refuge in the country, having separated him from his instruments, and deprived him of the means of making experiments, turned his attention to other objects. More than two years elapsed before he returned to these researches, on finding himself about to be appointed lecturer on optics in room of Dr. Barrow, who in 1669 generously retired in order to make way for him. He then endeavoured to mature his first results, and was led to a multitude of observations no less admirable from their novelty and importance, than for the sagacity, address, and method, with which he perfected and connected them. He composed a complete treatise, in which the fundamental properties of light were unfolded, established, and arranged, by means of experiment alone, *without any admixture of hypothesis*, a novelty at that time almost as surprising as these properties themselves. This formed the text of the lectures he began in Cambridge 1669, when scarcely twenty-seven years old, and thus we see, from what we have related concerning the succession of his ideas, that the *method of Fluxions*, the *theory of universal gravitation*, and the *decomposition of light*, i. e. the *three grand discoveries which form the glory of his life*, were *conceived in his mind before the completion of his twenty-fourth year.*

Although the lectures of Newton on optics must inevitably in the end have given publicity to his labours on light, he still refrained from publishing, wishing probably to reserve to himself the opportunity of adding a complete analysis of certain curious properties, of which, as yet, he had had but a slight glimpse. We refer to the intermittences of reflection and refraction which take place in thin plates, and perhaps in the ultimate particles of all bodies. It was not till two years later, that he made known some of his researches, and soon afterwards he was induced to give them full publicity. In 1671 he had been proposed as a Fellow of the Royal Society of London, and was elected on the 11th of January, 1672. In order that he might be qualified to receive this distinction, the rules of the society required that he should declare himself desirous of becoming a Fellow, and he could not do so in a more honourable manner than by offering some scientific communication. He forwarded to them a description of a new arrangement for reflecting telescopes, which rendered them more commodious in use by diminishing their length without weakening their magnifying powers. With regard to this invention, in which Newton had been preceded, probably without knowing it, by Gregory the Scotch mathematician, and by a Frenchman of the name of Cassegrain, it is merely necessary to observe that the construction offers in practice some inconveniences, which cause it to be little used. Nevertheless, when he presented a model of it,* of his own construction, it made a great impression in his favour among the members of the society, to whom probably the construction of Gregory's telescope was not yet well known. The letter which Newton wrote to the society on this occasion, ends with the following characteristic expression:—" I am very sensible of the honour done me by the Bishop of Sarum, in proposing me Candidate, and which I hope will be

* This model, made by Newton himself, is still preserved in the Library of the Royal Society.

further conferred upon me by my election into the society, and if so, I shall endeavour to testify my gratitude by communicating what my poor and SOLITARY endeavours can effect towards the promoting philosophical design."* The favourable reception which this proposal met with, induced Newton two months afterwards to make to the Royal Society another much more important communication, viz. the first part of his labours on the analysis of light. We can easily imagine the sensation which so great and unexpected a discovery must have produced. The society requested of him, in the most flattering terms, permission to insert this beautiful Treatise in the Philosophical Transactions.† Newton accepted this speedy and honourable method of publication; and in addressing his thanks to Oldenburg, their secretary, he says:—"It was an esteem of the Royal Society, for most candid and able judges in philosophical matters, encouraged me to present them with that discourse of light and colours, which since they have so favourably accepted of, I do earnestly desire you to return them my cordial thanks. I before thought it a great favour to be made a member of that honourable body, but I am now more sensible of the advantage: for believe me, Sir, I do not only esteem it a duty to concur with them in the promotion of real knowledge, but a great privilege that, instead of exposing discourses to a prejudiced and censorious multitude, (by which means many truths have been baffled and lost,) I may with freedom apply myself to so judicious and impartial an assembly."‡ It is but fair to say, for the honour of the Royal Society, that it has always shown itself, more than any other, worthy of this noble testimony which the most illustrious of its members has rendered to its justice. But though the suffrage and esteem of such a society may make amends for, yet they cannot prevent individual attacks. Newton himself was compelled to submit to the common destiny, which ordains that merit, and more particularly success, shall give rise to envy. By unveiling himself, he obtained glory, but at the price of his repose. At this period, Robert Hooke was a fellow of the Royal Society, a man of extensive acquirements, and of an original turn of thought, with great activity of mind and an excessive desire of renown. There were few departments of human knowledge to which he had not paid more or less attention: so much so, indeed, that it was hardly possible to find any subject of research upon which he did not profess to have original views; or to propose any new invention of which he did not claim the prior discovery. There was then the more opportunity of setting in action and of gratifying his jealous spirit, as all the physical and natural sciences were, at that time, mixed up with theoretical opinions; and there were few men then to be met with who could distinguish the difference between a vague perception and a precise idea—between a physical hypothesis and a law of nature rigorously demonstrated. Hooke himself was no exception to this remark; and unfortunately he was not sufficiently familiar with pure mathematics to make use of them as a means of calculation, either in proving or perfecting a theory. A thorough acquaintance with this instrument was the great advantage possessed by Newton, and which assured to his researches a precision and a certainty hitherto unknown in science. The investigation of the properties of light presented by him to the Royal Society, eminently possessed this rigorous character. It consisted in showing experimentally a certain number of physical properties, which were thus established as matters of fact without any admixture of hypothesis, and without requiring any previous knowledge in what the nature of light consisted. When the first feelings of surprise and admiration excited by this noble work had subsided, the Royal Society appointed three members to study the treatise fully, and to give an account of it. Hooke, being one of the number, undertook to draw up the report. Already on the occasion of Newton presenting his telescope, Hooke had announced that he possessed an infallible method of improving all sorts of optical instruments, so that* "whatever almost hath been in notion and imagination, or desired in optics, may be performed with great facility and truth." Nevertheless, he did not explain this method, but confined himself, in accordance with the conceits of his

* Birch, vol. iii. p. 3.

† At that time published in monthly numbers, by the Royal Society.

‡ Dated Trinity College, February 10th, 1671.

* Birch, vol. iii. p. 4.

day, to masking it under the form of an anagram; of which, however, he appears not to have been able to produce the explanation, since neither he nor any other person has ever realised these wonderful promises. His report on Newton's work was, if not of the same kind, yet conceived in the same spirit of personality: for, instead of discussing the new facts, singly, and as compared with the original experiments, he examined them only in relation to an hypothesis which he had formerly imagined, and which consists in regarding light not as an emanation of very small particles, but as the simple effect of vibrations excited and propagated in a very elastic medium. This conception of the nature of light may be in itself as true as any other, since that nature is still entirely unknown to us; but, in order to place such an hypothesis on an equal footing with another hypothesis, shown by calculation to be consistent with experiment and observation, it ought to be detailed with exactness, and to be rigorously accordant with mathematical calculation. The first of these conditions was far from being fulfilled by Hooke, who substituted in its stead a sketch exceedingly vague, and materially contrary to experiment. He supposed, for instance, that there are only two colours essentially distinct, namely, the violet and the red, of which all the others are but mixtures.

With regard to the second condition, viz., an accordance with calculation, it was then far from possible to submit the system of undulations to rigorous mathematical investigation; since that is more than even, at the present time, those mathematicians have been able to accomplish who have been most occupied with the subject. To so vague a theory did Hooke refer, as a standard, the physical truths which Newton had discovered. He concluded by dictatorially allowing all that appeared to him to be reconcileable with his own hypothesis, and by advising him not to seek any other explanation of the facts.* Newton replied to this attack in a severe and decisive tone.† After refuting an error that Hooke had committed, in supposing the spherical aberration in reflectors greater than that in refracting lenses, he shows that Hooke had judged of the facts he had announced, not by means of the observations that supported them, but by their accordance or discordance with a previously conceived hypothesis; that this hypothesis was vague and unsatisfactory, and that, for his own part, he had not wished to support any hypothesis whatever, as in fact he had no need of one, but that he had only aimed at establishing the real properties of light upon actual observation. Finally, he adduced new experiments, confirming the results which he had already obtained, and refuted the inaccurate assertions of Hooke with respect to the possibility of reducing all colours to two simple ones; as well as his objections to the production of whiteness by the mixture of all the rays. This paper, which nearly completed Newton's investigation into the properties of light, was published by the Royal Society in the Philosophical Transactions of Nov. 1672. Hooke did not reply to this, but presuming, and with good reason, after Newton's first treatise, that such an experimentalist would soon be on the track of all that remained to be discovered concerning the physical properties of light, he hastened to present to the Royal Society several important observations on optics. Among them, we may remark a very precise and faithful account of the changeable colours that appear in the form of rings on soap bubbles, and in the thin plates of air included between pieces of glass pressed together; but without any determination of the physical law or measure even of the breadth and intervals of the rings. Two years afterwards (18th of March, 1674), he read another memoir, in which he detailed the fundamental phenomena of *diffraction*, which had been already discovered and described by Grimaldi;* but, what is still more remarkable, he then announced another principle, which, under the name of the *principle of interferences*, has since become one of such frequent and advantageous application.

This principle is, that colours are produced when two rays of white light arrive simultaneously at the eye, having directions so little different that this organ takes them to be one ray. We shall afterwards see that (as Hooke had

* Birch, Hist. R.S. vol. iii. p. 10.
† Philosoph. Transact. vol. vii. No. 88.

* These discoveries were given to the world in Grimaldi's posthumous work, *Physico-mathesis de lumine, &c.* (Bononiæ, 1665, in 4to.)—a book also containing the undulatory hypothesis afterwards reproduced by Hooke. Vide Montucla, Histoire des Mathématiques, vol. ii.

anticipated) Newton was induced subsequently to occupy himself with these new phenomena; but, in the mean time, he was exposed to several absurd attacks upon his experimental analysis of light. Such, for instance, was that of a Jesuit named Pardies, who pretended that the elongation of the refracted image, whence Newton inferred the unequal refrangibility of the rays, was produced entirely by a difference in their original incidences on the first face of the prism: a supposition, the inaccuracy of which the most simple calculation would have been sufficient to show; and which Newton had previously refuted in his own Memoir. But still more foolish was the assertion of one Linus, a physician of Liege, who pretended never to have been able to produce by refraction through a prism an *elongated* image, but only a *round* and *colourless* one; whence he concluded that Newton had been led into error by the accidental passage of some bright cloud, which had elongated and coloured the image; adding also that he himself should not have been astonished had the image been elongated in the longitudinal direction of the prism; but that, without violating the rules of optics, it was impossible to imagine its elongation in the transverse direction. This was accompanied by several authoritative remarks on the improbability of what he called the new *hypothesis*, which Newton had imagined simply to be a statement of facts. These absurdities, as soon as presented, were printed in the Philosophical Transactions; and Newton was obliged to take the trouble to answer them methodically, to prevent their being accredited by that envy which showed itself so eager to receive them. He was compelled to reply to Huygens, who, though really a man of talent, made objections as unphilosophical nearly as the others, since he compared the properties discovered experimentally by Newton with an hypothesis of his own on the nature of light, in the same manner as Hooke had compared them with his hypothesis, and Pardies and Linus with the ancient ones. In vain did Newton reply that he neither advanced nor admitted any hypothesis whatever, but that his sole object was to establish and connect facts by means of the laws of nature. This severe and abstract method of reasoning was then too little understood. It is scarcely conceivable into what details he was obliged to enter in the discussion; and such was the disgust with which this inspired him, that he gave up his previous intention of printing his lectures on Optics with his treatise on Series, and determined to commit himself no more with the public.* "I was," he afterwards wrote to Leibnitz, "so persecuted with discussions arising from the publication of my theory of light, that I blamed my own imprudence for parting with so substantial a blessing as my quiet, to run after a shadow." It was, perhaps, the remembrance of these inconsiderate objections of Huygens, that afterwards inclined Newton to regard less favourably than he ought to have done, the law of double refraction in Iceland spar, discovered by this eminent mathematician, probably by experiment after Newton's own manner, though he presented it as a deduction from his own favourite system, and as a confirmation of it. It is easy to understand how much Newton must have been grieved by the opposition of so illustrious an adversary as Huygens, since he might at least have hoped to have been understood and appreciated by minds accustomed to the severity of mathematical investigations. Nevertheless, before quitting the lists, Newton wished finally to complete the account of the results which he had obtained, and of the views which he had formed on the nature of light. This was the object of a later paper addressed to the Royal Society.†

We there find an experimental analysis of the colours observed in thin plates—phenomena, which, as we have said, had been previously pointed out and described by Hooke, but without his having either measured the spaces occupied by the colours, or determined the law which they followed. Newton first measured the spaces with admirable precision and nicety, and thence derived the physical laws by which all these results are connected with, and may be deduced from each other.

This treatise, united with his first paper on the analysis of Light, afterwards served as a base for the grand work published in 1704, under the name of *Newton's Treatise on Optics;* with this difference, however, that in the latter work the experimental investigation of

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* Comm. Epist. LVII.

† Dated 9th Dec. 1675. Birch, vol. iii. pp. 247, 261, 296.

the phenomena is more extensive and more strictly separated from all hypothesis. The new experiments with which Newton enriched it, relate principally to the colours observed in the *thick* plates of all bodies, when they are presented in a proper manner to the incident ray. Newton reduces them to the same laws as those of the phenomena in *thin* plates; and then considering these laws as established facts equally certain with the particular experiments from which they are deduced, yet far more universal, he unites them all in one general property of light, each peculiarity of which is characterized with such exactness, as to make the general property a pure expression for all the observed laws. The essence of this property is, that each particle of light, from the instant when it quits the radiating body whence it emanates, is subject periodically and at equidistant intervals, to a continual alternation of dispositions to be reflected from or to be transmitted through the surfaces of the diaphanous bodies it meets with; so that, for instance, if such a surface presents itself to the luminous particle during one of the alternations when the tendency to reflection is in force, which Newton has appropriately termed *the fit of easy reflection*, this tendency makes it yield more *easily* to the reflecting power of the surface; while, on the other hand, it yields with more *difficulty* when it is in the contrary phase, which Newton has termed the *fit of easy transmission*. We have here an admirable example of the universal application of scientific definitions when framed in strict accordance with experiment. For, though the term *fits*, inasmuch as it seems to imply a physical property, is applicable in its first intention to material particles only, and thus involves the assumption of the materiality of light, (a fact of which we may reasonably doubt, though Newton has never treated it as doubtful,) yet the characteristics of these fits are described in such exact conformity with experiment, that they would exist without any change, even were it discovered that light is constituted in any other manner—that it consists, for instance, in the propagation of undulations: such is the point of view in which Newton regards these fits in his Optics, 1704, limiting himself to deduce from them his profound inductions, on the intimate constitution of bodies, and on the cause which renders them apt to reflect or transmit a particular colour. But in his paper of 1675, he connected these properties with a very bold physical hypothesis, so general, that, from it, he deduced the nature of light and of heat, and the explanation of all the phenomena of combination or motion which appear to result from certain intangible and imponderable principles. As this hypothesis (mentioned only in the History of the Royal Society) is little known, and as it appears to have been constantly connected with Newton's thoughts on the constitution of the universe, we may here give a summary of it. We do this without the intention either of defending or combating it, but in order that the reader may see precisely in what the general views of Newton from this time forward consisted, and how, while they continued unchanged by lapse of time, he made a more or less explicit declaration of them according to circumstances. Newton, in the first place, excuses himself for proposing a conjecture as to the nature of light, declaring that he does not need one, and that the properties which he has discovered being physical facts, their being explicable or not by this or that hypothesis, could not in any degree add to or take away from their certainty;* "but," says he, "because I have observed the heads of some great virtuosos to run much upon hypotheses, I will give one which I should be inclined to consider as the most probable, if I were obliged to adopt one." He then admits, nearly as Descartes had previously done, the existence of a fluid imperceptible to our senses, which extends everywhere in space, and penetrates all bodies, with different degrees of density. He supposes this fluid to be more dense in bodies which contain in the same volume a less number of constituent material particles; he supposes also that the density of this fluid varies around each different body, and even around each constituent particle, increasing rapidly near their surface, and afterwards more slowly, though by insensible degrees, as the distance from the surface becomes greater. This fluid (which Newton calls *ætherial medium or æther*, in order to characterize by this denomination its extreme tenuity) he also considered as highly elastic; and consequently by the effort which it makes to spread, that it presses against itself, and against the material parts of

* Birch, Hist. R.S. vol. iii. p. 249.

other bodies, with an energy more or less powerful according to its actual density, and thus that all these bodies continually tend towards one another; the inequality of the pressure urging them always to pass from the denser into the rarer parts of the æther. Conformably to his opinion respecting the disposition of the æther around each body, and around each of its material constituent particles, he considered that the variations of its density between a body and a vacuum, or between one body and another neighbouring body, were not sudden and discontinuous, but gradual and progressive; and from being very rapid near the surfaces, where the nature or density of the matter instantaneously changes, they a little farther become so slow as soon to cease to be perceptible beyond certain limits of thickness inappreciable to our senses. If, then, this æther be disturbed or agitated, in any one point, by any cause whatever, producing a vibratory movement, this motion must transmit itself by undulations through all the rest of the medium, in the same way that sound is transmitted through air, but much more rapidly, by reason of the æther's greater elasticity; and, if those undulations, successively reiterated, happen to encounter in their passage the material particles forming the substance of any body, they will agitate them with considerable force, by the quick and periodical repetition of their successive impressions, in precisely the same way that we see solid bodies, and sometimes even the whole mass of a large building, tremble under reiterated impulses of the weak undulations in the air, excited by the sounds of an organ, or by the rolling of a drum.

Now Newton does not suppose that light immediately results from the impression produced by these undulations on the nervous membrane of the retina, as Descartes and Hooke had previously done, and as, in general, has been done by all those who have followed the same system. The principal reason which Newton gives for rejecting this supposition is, that a motion excited in, and transmitted through, an elastic fluid which reposes on another fluid of a different density, does not seem capable of being reflected in the first fluid at their surface of common separation, without being in part transmitted into the second; whereas, in many cases, light, propagated into the interior of bodies, is totally reflected at their second surface, and again returns into their interior without the smallest part of it going out. Newton, therefore, admits that light consists of a peculiar substance different from the æther, but composed of heterogeneous particles, which, springing in all directions from shining bodies, with an excessive though measurable velocity, agitate the æther in their passage, and excite in it undulations; by the meeting of which, they become liable to be in their turn accelerated or retarded. Newton does not attempt to characterize the essence of these particles, but merely the faculty that he attributes to them of agitating the æther, and of being agitated by it; and finally he adds,* "those that will, may suppose it, multitudes of unimaginable small and swift corpuscules of various sizes springing from shining bodies at great distances one after another; but yet without any sensible interval of time; and continually urged forward by a principle of motion, which, in the beginning, accelerates them till the resistance of the ætherial medium equal the force of that principle, much after the manner that bodies let fall in water are accelerated, till the resistance of the water equals the force of gravity." Be this as it may, the independence of the particles of light and of æther being admitted, as well as their mutual reaction, Newton takes the case of a ray of light moving through a space in which the ætherial medium is composed of strata of unequal density; and applying to the particles of this ray the general principle established above, he concludes that they ought to be pressed, urged, or generally acted upon, so as to go from the denser to the rarer strata of æther; whence they must receive an accelerated velocity, if this tendency conspire with the proper motion of the ray; and a retarded velocity, if it be contrary to it; and generally a curvilinear deviation when the proper motion of the ray and the impression produced by the elastic medium are oblique to one another.

This is precisely what must happen when rays of light pass from one transparent homogeneous body into another, since the æther is there supposed to be of different densities; and the deviation of the rays takes place only near the common surface of the two bodies, where the sensible variation of density begins, whence results the phenomenon

* Birch, Hist. R.S. vol. iii. pp. 254, 5.

of refraction.* "Now," says Newton, "if the motion of the ray be supposed in this passage to be increased or diminished in a certain proportion, according to the difference of the densities of the ætherial mediums, and the addition or detraction of the motion be reckoned in the perpendicular from the refracting superficies, as it ought to be, the sines of incidence and refraction will be proportional, according to what Descartes has demonstrated." This explanation of refraction is exactly the same as Newton afterwards reproduced in the *Principia*, though without there pronouncing any opinion on the nature of the disturbing force. It is, however, probable, that in his Memoir he deduced it by simple induction, rather than by a mathematical investigation; for it does not appear that, at this epoch, he was acquainted with the calculation of curvilinear motions. It is, however, important to remark, that from this time he had formed a conception of the doctrine of universal gravitation; for he takes care to point out that the unequal density of the æther, at different distances from the surface of bodies, suffices to determine their mutual tendency towards one another; a consideration which he again brought forward in the Queries annexed to his Optics (in 1704), after he had discovered the laws of the system of the world. Nevertheless we may infer, that in 1675, he had not yet formed the idea of attractions at small distances, since, in his paper addressed to the Royal Society, he imagines that the ascent of liquids in capillary tubes is caused by the air being more rare in confined than in open spaces, and the more rare in proportion as the spaces are more confined. While in the Queries he attributes these phenomena to their true cause, viz. to the reciprocal attractions of the tubes and of the fluid; though, even at this later period, he did not know how to calculate their effect. It was reserved for LAPLACE to complete this investigation.

After having thus considered the simple transmission of rays in ætherial strata of unequal densities, Newton examines the modifications produced during this transmission, by their meeting with undulations originally excited in the æther itself, according as such undulations may favour or oppose the actual motion of the luminous particles; and by this re-action he is enabled to explain the intermittances in reflection and refraction, which take place in thin plates. We may observe in his Optics, that he has never abandoned this idea; for though in that work he has maintained the most complete reserve with regard to the nature of light, yet, after characterizing the fits as a purely abstract physical property, he gives as a method of rendering it sensible, the same manner of conceiving it that he had given in his Memoir of 1675; the same idea is reproduced in several of the *Queries*, particularly in the 17th, and those following to the 24th, where Newton asks, as in the paper presented to the Royal Society, if this same æther be not also sufficient to produce universal gravitation, and even all the phenomena of animal motion? Finally, in his paper, he endeavours to apply the same principles to the inflections, undergone by rays of light on passing near the extremities of bodies; which he, in like manner, explains by variations in the density of the æther. It is always thus that he has represented these inflections, both in the Principia, printed in 1687, and in the Queries.

From these examples, taken together, we may see that Newton did *not* "several times change his ideas on light," as has been asserted by some writers, but that, always preserving the same opinion, he has explained it more or less fully, as different occasions demanded.

The phenomena of diffraction, however, were still too imperfectly known, and observed with too little detail for enabling Newton to see precisely whether they agreed or not with his hypothesis. We have reason to believe that, in order to study these properties, he then made a number of experiments, to be afterwards inserted at the end of the Optics; for he there introduces them as part of an investigation which he had formerly undertaken, but from which his thoughts were now so far estranged, that he had lost the taste for resuming it. These observations, like all his others, are presented as matters of fact, without relation to any system. When the hypothesis of Newton on the nature of light was presented, in 1675, to the Royal Society, Hooke, as usual, put in his claims to it. Newton, however, did not again waste his time and repose in a controversy on the subject, but contented himself with writing to Oldenburg (21st December), in order to make

* Birch, Hist. R.S. vol. iii. p. 256.

him see the injustice of that jealous individual. He first clearly shows that his fundamental idea has nothing in common with that of Hooke, inasmuch as the latter supposes light to consist in the undulations themselves of the æther, transmitted to the organ of vision; while the light of Newton is a substance entirely distinct, which, thrown into the æther, impresses upon, or receives from it, peculiar motions, by means of which it acts upon us. "As to the observations of Hooke on the colours in thin plates, I avow," says Newton, "that I have made use of them, and thank him for the same; but he left me to find out and make such experiments about it, as might inform me of the manner of the production of those colours, to ground an hypothesis on; he having given no further insight to it than this, that the colour depended on some certain thickness of the plate; though what that thickness was at every colour, he confesses, in his Micrography, he had attempted in vain to learn; and, therefore, seeing I was left to measure it myself, I suppose he will allow me to make use of what I took the pains to find out; and this I hope may vindicate me from what Mr. Hooke has been pleased to charge me with."* Happily this time the discussion proceeded no further; and Oldenburg had sufficient influence, as well as sufficient sense, to prevent its obtaining notoriety. From this time till the year 1679, four years afterwards, Newton communicated nothing to the Royal Society. Oldenburg, whose kindness had ever encouraged him, unfortunately died in this interval, and was succeeded in the secretaryship by Hooke, an appointment little likely to remove an apprehension of new disputes. We may imagine, however, that Newton did not remain idle; and, in fact, in this interval, it appears, he was principally occupied with astronomical observations. At last, 28th November, 1679,† he had occasion to write to Hooke about a System of Physical Astronomy, on which the Royal Society had asked his opinion. In his letter he proposed, as a matter deserving attention, to verify the motion of the earth by direct experiment, viz. by letting bodies fall from a considerable height, and then observing if they follow *exactly* a vertical direction; for if the earth turns, since the rotatory velocity at the point of departure must be greater than that at the foot of the vertical, they will be found to *deviate* from this line towards the east, instead of following it *exactly* as they would do if the earth did not revolve. This ingenious idea being very favourably received, Hooke was charged to put it into effect. On reflection, Hooke immediately added the remark, that wherever the direction of gravity is oblique to the axis of the earth's rotation, *i. e.* in all parts of the earth, except at the equator, bodies, in falling, change parallels, and approach the equator: so that in Europe, for instance, the deviation does not take place, rigorously speaking, to the east, but to the south-east of the point of departure. Hooke communicated this remark to Newton, who immediately recognized its correctness in theory; but, in addition to this, Hooke assured the Royal Society that, on repeating the experiment several times, he had actually found that the deviation took place constantly towards the south-east; an accordance which would appear very simple, if Hooke's remarks were merely theoretical; but which must appear very extraordinary if he intended to speak of an actual *observed* deviation reckoned from the foot of the vertical; for in this case, according to the formulæ of Laplace, the tendency to the south is of the second order, relative to the absolute deviation; and in Hooke's observations this very slight deviation must have been excessively difficult to ascertain, since his experiments were made in the open air. It was this, however, which led Newton to consider whether the elliptical motion of the planets could result from a force varying inversely as the square of the distance, and if so, under what circumstances such a result would ensue. In fact, in proposing to the Royal Society his curious experiment, he had considered the motion of the heavy body as determined by a force of constant intensity, and had concluded the trajectory to be a spiral,* doubtless, because he imagined the body to fall in a resisting medium, such as the air. Hooke, who for a long time had adopted the hypothesis of a force decreasing as the squares of the distance from the centre, replied that the trajectory ought

* Birch, Hist. R. S. vol. iii. p. 279.
† Ibid. vol, iii. p. 512.

* Vide Newton's original Letters in the Biographia Britannica, article Hooke, p. 2659.

not to be a spiral, but that in a vacuum it would be an *excentric ellipse*, which would change into an ovoidal curve likewise excentric, if the medium were a resisting one. It is impossible exactly to ascertain how Hooke arrived at these results, for neither then, nor on any subsequent occasion, did he give a demonstration of them; though Halley and Sir Christopher Wren both eagerly pressed him to do so. We might imagine, not without some probability, that the elliptic movement of projectiles was, in his mind, a consequence of the hypothetical, though just, ideas he had formed on the physical cause of the planetary motions; for he attributed them to the existence of a gravitating force, proper to each celestial body, and acting round its centre, with an energy inversely proportional to the square of the distance; so that, in this system, the motion of projectiles round the centre of the earth ought to be elliptical, because, according to observation, the motion of the planets was elliptical round the sun. Hooke had, for some time, turned his thoughts to this kind of speculation; but not being a sufficiently profound mathematician, rigorously to deduce the nature of the force from the form of the orbits, or to show how this form resulted from the supposed law of attraction, he tried to determine its character by direct physical experiments, and actually to produce the motions which resulted from the law, by means of mechanical contrivances. On the 21st March, 1666, he communicated to the Royal Society certain experiments, which he had attempted, in order to determine whether the weight of a body undergoes any variation at different distances from the earth's centre, at the greatest altitudes or depths which can be attained. These experiments were made with too little precision to give results on which any reliance could be placed. Hooke himself perceived this, and proposed to employ the more delicate process of using a pendulum clock, and successively observing its rate at different heights. This first attempt, though imperfect, shows the object he had in view, which perhaps is more clearly seen in his own words. "Gravity, though it seems to be one of the most universal, active principles in the world, and consequently ought to be the most considerable, yet has it had the ill fate to have been always, till of late, esteemed otherwise, even to slighting and neglect. But the inquisitiveness of this latter age hath begun to find sufficient arguments to entertain other thoughts of it. Gilbert began to imagine it a magnetical attractive power, inherent in the parts of the terrestrial globe. The noble Verulam also, in part, embraced this opinion; and Kepler (not without good reason) makes it a property inherent in all celestial bodies,—sun, stars, planets. This supposition we may afterwards more particularly examine; but first it will be requisite to consider, whether this gravitating or attracting power be inherent in the parts of the earth; and, if so, whether it be magnetical, electrical, or of some other nature distant from either. If it be magnetical, any body attracted by it ought to gravitate more, when nearer to its surface, than when further off.*"

Two months afterwards, Hooke made before the Royal Society another experiment, which, as he himself observed, without being an exact representation of the planetary orbits, afforded an example, at that time new and remarkable, of a curvilinear motion produced by the combination of a primitive impulse with an attracting power emanating from a centre. He suspended from the ceiling of a room a long wire, to the end of which was attached a ball of wood, to represent a planetary body. On removing this pendulum from the vertical, and giving it a lateral impulse perpendicular to the plane of deviation, it is acted on by two forces, of which one is the impulse itself, and the other terrestrial gravity, of which the effort, when decomposed perpendicularly to the wire, tends always to bring the body back to the vertical. Now when the lateral impulse was nothing, the ball clearly described a plane orbit, viz. that of its free oscillation; if the impulse, without being nothing, were still very weak, the trajectory became a very much elongated ellipse, having its major axis in the plane of oscillation; with a stronger impulse, a more open ellipse was obtained, which, at a particular point, became an exact circle; and lastly, still stronger impulses produced ellipses, whose major axes were no longer parallel with, but were perpendicular to the plane of free oscillation. Thus these different curves were seen to be produced and to be transformed into each

* Birch, Hist. R. S. vol, ii., p. 70.

other, by merely changing the relative energies of the two forces (the one impulsive, and the other central) which acted on the pendulum. These ellipses, however, differed from the planetary ellipses, inasmuch as the central force produced by the decomposition of gravity is constantly directed towards the *centre* of the ellipse, and is *directly* proportional to the distance of the body from that centre; whereas, in the planetary orbits, the central force is constantly directed towards *one of the foci* of the ellipse, and is *reciprocally* proportional to *the square* of the distance of the body from that point. Notwithstanding this fundamental distinction, the experiment of Hooke was important and useful, as it gave a perceptible example of the composition of forces. Eight years later, in 1674, Hooke presented the whole of his ideas in a much more explicit and complete manner, at the end of a dissertation, entitled, "*An Attempt to prove the Motion of the Earth from Observations*."* "I shall," says he, "hereafter explain a system of the world, differing in many particulars from any yet known, answering in all things to the common rules of mechanical motions. This depends upon three suppositions:—first, that all celestial bodies whatsoever have an attraction or gravitating power towards their own centres, whereby they attract not only their own parts and keep them from flying from them, as we may observe the earth to do, but that they do also attract all the other celestial bodies that are within the sphere of their activity, and consequently, that not only the sun and moon have an influence upon the body and motion of the earth, and the earth upon them, but that Mercury, Venus, Mars, Jupiter, and Saturn also, by their attractive powers, have a considerable influence upon its motion, as in the same manner the corresponding attractive power of the earth hath a considerable influence upon every one of their motions also. The second supposition is this, that all bodies whatsoever, that are put into a direct and simple motion, will so continue to move forward in a straight line, till they are, by some other effectual powers, deflected and bent into a motion describing a circle, ellipsis, or some other more compounded curve line. The third supposition is, that those attractive powers are so much the more powerful in operating, by how much the nearer the body wrought upon is to their own centres. *Now what these several degrees are I have not yet experimentally verified;* but it is a notion which, if fully prosecuted, as it ought to be, will mightily assist the astronomers to reduce all the celestial motions to a certain rule, which I doubt will never be done true without it. He that understands the nature of the circular pendulum and circular motion will easily understand the whole ground of this principle, and will know where to find directions in nature for the true stating thereof. This I only hint at present to such as have ability and opportunity of prosecuting this inquiry, and are not wanting of industry for observing and calculating, wishing heartily such may be found, having myself many other things in hand, which I would first complete, and therefore cannot so well attend it. But this I durst promise the undertaker, that he will find all the great motions of the world to be influenced by this principle, and that the true understanding thereof will be the true perfection of astronomy."

Without lessening the credit due to the distinct expression of such remarkable ideas, it is proper to observe, that we find in Hooke's work no measured result. We do not allude only to the law of force, which is here entirely omitted: we have said that Hooke supposed it to be reciprocal to the square of the distance; but others before him, and among them Bouillaud,* had established the same supposition, on simple metaphysical considerations. Halley again did the same, after Hooke and Bouillaud. We have a convincing proof that Hooke arrived at this conclusion in no other way, from his saying that *he had not yet experimentally verified* the law of decrease in the attracting force; for he would not have thus expressed himself if he had discovered this law *directly*, by applying the theorems of Huygens on centrifugal forces to the observed orbits of the planets; for in this case the experiment would have been already made, and the law of the squares, thus obtained, would have needed no other verification. The generalization of the idea of gravity, and its extension to all celestial bodies, decreasing in intensity according to the distance, was formally

* London, 4to. 1674.

* Bullialdus, *Astronomia Philolaïca.*

expressed by Borelli* in 1666, in his work on the Satellites of Jupiter; and not only did he announce it as a general principle, but he explained very clearly how the planets may be retained and suspended in empty space round the sun, in the same manner as the satellites round their planets, by the action of a power continually and exactly balanced by the centrifugal force caused by their rotation, without having recourse either to the solid heavens of Aristotle, or to the vortices of Descartes. Borelli even endeavoured to deduce from this combination of forces the elliptical motions of the satellites, and the inequalities in their motions, which he considered as being partly produced by the secondary action of the sun; and though, from his being unacquainted both with the law of this force at different distances, and with the Theorems on Central Forces, published by Huygens six years afterwards, he was, of course, unable rigorously to establish these deductions; yet there was much merit in being the first to guess and perhaps to indicate the possibility of doing so. Newton also, we shall presently see, attributes to Borelli the honour of having first formed the idea of extending the principle of gravitation, and of applying it to the planetary motions; and Huygens renders him the same justice in his *Kosmotheoros*,† where he mentions these happy perceptions, immediately before speaking of the demonstrations of Newton. It is not then by any means impossible that Hooke might have been conducted to the same thoughts by similar, that is by purely physical considerations; and we shall presently see reasons that render this conjecture extremely probable. However, in whatever manner he formed these opinions, it is clear that in 1679 he considered them as undoubtedly correct; for, in writing to Newton on the motion of projectiles, he represents the eccentric ellipse as the consequence of a force reciprocal to the squares of the distances from the centre of the earth. This remarkable relation could not fail of striking a mind which had so long and so constantly studied the motions of the heavens. Newton, as we have already said, hastened to examine this result, by means of mathematical calculations, and discovered its truth; that is to say, he found that an attractive force, emanating from a centre, and acting reciprocally to the squares of the distances, necessarily compels the body on which it acts, to describe an ellipse, or in general a conic section, in one of whose foci the centre of force resides. The motions produced by such force exactly resemble the planetary motions, both in regard to the form of the orbit and the velocity of the body at each point. This was evidently the secret of the system of the world; but it still remained to account for the singular discordance which the moon's motion had offered to Newton, when, in 1665, he had wished to extend to her the earth's gravity diminished according to this law. Hence it was that, notwithstanding his inference was confirmed by other inductions, he abstained from publishing any thing upon the subject. Three years afterwards, however, (in June, 1682,) Newton being present at a meeting of the Royal Society, in London, the conversation turned on a new measurement of a terrestrial degree, recently executed in France, by Picard, and much credit was given to the care taken in rendering it exact. Newton, having noted down the length of the degree obtained by Picard, returned home immediately, and taking up his former calculation of 1665, began to recompute it from the new data. Finding, as he advanced, the manifest tendency of these numbers to produce the long wished for results, he suffered so much nervous excitement, that becoming at length unable to go on with the calculation, he entreated one of his friends to complete it for him. This time the agreement of the computed with the observed result was no longer doubtful. The force of gravity at the earth's surface, as determined by experiments on falling bodies, when applied to the moon, after being diminished proportionally to the square of the distance from the centre of the earth, was found to be very nearly equal to the centrifugal force in the moon, as concluded from its distance and angular velocity obtained by observation. The small difference which still existed between the two results, was in itself a new proof of exactness; for if we suppose an attractive power to emanate from all the celestial bodies inversely proportional to the squares of

* *Theoricæ medicearum planetarum ex causis physicis deductæ.* (Firenze, 1666.) This same Borelli was the author of the celebrated work *de Motu Animalium.*

† Vid. lib. ii, p. 141. *Christianii Hugenii Kosmotheoros, sive de terris cœlestibus, eorumque ornatu conjecturæ.* (4to. Hagæ Comm. 1698.)

their distances from the bodies which they attract, the motion of the moon ought not only to depend upon its gravity towards the earth, but also to be influenced by the action of the sun; for this effect, though exceedingly weakened by the distance, ought not to be wholly imperceptible in the result.

Thus Newton ceased to doubt; and after having been, during so many years, kept in suspense about this eminently important law, he had no sooner recognized its truth, than he penetrated instantly to its most remote consequences, pursued them all with a vigour, a perseverance, and a boldness of thought, which, till that time, had never been displayed in science. Indeed it seems hardly probable that it will, at any future time, be the destiny of another human being to demonstrate such wonderful truths as these; that all the parts of matter gravitate towards one another, with a force directly proportional to their masses, and reciprocally proportional to the squares of their mutual distances; that this force retains the planets and the comets round the sun, and each system of satellites around their primary planets; and that, by the universally communicated influence which it establishes between the material particles of all these bodies, it determines the nature of their orbits, the forms of their masses, the oscillations in the fluids which cover them, and, in fine, their smallest movements, either in space or in rotation upon their own axes, and all conformably to the actually observed laws. The finding of the relative masses of the different planets, the determination of the ratio of the axes of the earth, the pointing out the cause of the precession of the equinoxes, and the discovery of the force exercised by the sun and the moon in causing the tides, were the sublime objects which unfolded themselves to the meditations of Newton, after he had discovered the fundamental law of the system of the universe. Can we wonder at his having been so much excited as not to have been able to complete the calculation which was leading him to a conviction that the discovery was achieved?

It was now that he must have experienced intense satisfaction at having so profoundly studied the manner in which physical forces act, and at having sought by so many experiments to comprehend, and exactly to measure their different effects. More particularly must he have been delighted at having created that new calculus, by means of which he was enabled to develope the most complicated phenomena, to bring to light the simple elements of motion, and thus to obtain the forces themselves from which the phenomena result; and finally, to re-descend from these forces to the detail of all their effects: for, with equal talent, had he not possessed this instrument of investigation, the complete unfolding of his discovery would have been impossible. But, possessing the means, he had only to apply them; and thus he saw the constant object of his hope attained. Henceforward, he devoted himself entirely to the enjoyment of these delightful contemplations; and during the two years that he spent in preparing and developing his immortal work, *Philosophiæ naturalis Principia Mathematica*, he lived only to calculate and to think. Oftentimes lost in the contemplation of these grand objects, he acted unconsciously: his thoughts appearing to preserve no connexion with the ordinary concerns of life. It is said, that, frequently on rising in the morning, he would sit down on his bedside, arrested by some new conception, and would remain for hours together, engaged in tracing it out, without dressing himself. He would even have neglected to take sufficient nourishment, had he not been reminded by others of the time of his meals.*

It was only by the uninterrupted efforts of solitary and profound meditation, that even Newton was able to unfold all the truths he had conceived, and which were but so many deductions from his great discovery. We may learn from his example, on what severe conditions even the most perfect intellect is able to penetrate deeply into the secrets of nature, and to enlarge the bounds of human attainments. For himself, he well knew, and willingly confessed, the inevitable necessity of perseverance and

* The following anecdote is told on this subject. Dr. Stukely, an intimate friend of Newton, called upon him one day when his dinner was already served up, but before he had appeared in the dining-room. Dr. Stukely having waited some time, and becoming impatient, at length removed the cover from a chicken, which he presently ate, putting the bones back into the dish and replacing the cover. After a short interval, Newton came into the room, and after the usual compliments, sat down to dinner, but on taking up the cover, and seeing only the bones of the bird left, he observed with some little surprise, "I thought I had not dined, but I now find that I have."

constancy in the exercise of his attention, in order to develope the power of thought. To one who had asked him on some occasion, by what means he had arrived at his discoveries, he replied, "By always thinking unto them;" and at another time he thus expressed his method of proceeding. "I keep the subject constantly before me, and wait till the first dawnings open slowly by little and little into a full and clear light." Again, in a letter to Dr. Bentley, he says, "If I have done the public any service this way, it is due to nothing but industry and patient thought." With such tastes and habits, the complete command of his own time, and of his own ideas, was his highest enjoyment. Thus, notwithstanding the importance of the results he had obtained, Newton was not eager to establish a title to them by publication, and perhaps he would have even longer delayed giving them to the world had an accidental circumstance not induced him to do so. About the beginning of 1684, Halley, one of the greatest of the English astronomers, and, at the same time, one of the most enlightened and active minds that have ever cultivated science, formed the idea of employing the *Theorems of Huygens on central forces*, to determine the tendency in the different planets to recede from the sun, by virtue of their revolutions about that body, their orbits being considered as circular. From the ratios discovered by Kepler between the times of these revolutions, and the major axes of the orbits, he recognized these tendencies to be reciprocally as the square of the distances of each planet from the sun, so that the attraction which this luminary exerts to keep them in their places, must also vary according to the same law. This was precisely the idea that Newton had conceived in 1666, and from which he had drawn the same consequence. But there was yet a long way from this, to the rigorous calculation of curvilinear motions when the law of the force is given. Halley perceived the difficulty of this step, and after having in vain endeavoured to remove it, he consulted Hooke, at Sir Christopher Wren's house, without, however, receiving any light on the subject, although Hooke had boasted before them both that he had completely resolved this grand question. At last, impatient to see an idea unfolded, which appeared to him so fertile in consequences, Halley went to Cambridge in 1692, purposely to confer with Newton on the subject. It was then that Newton showed to him a Treatise on Motion, in which Halley found the desired solution. This treatise, with some additions, afterwards formed the two first books of the Principia. It would appear that, at this time, Newton had already introduced, and explained some parts of it, in his lectures at Cambridge. Halley, delighted at seeing his hopes realized, requested Newton to confide to him a copy for insertion in the registers of the Royal Society, in order to secure to him the honour of so important a discovery. Although Newton had an extreme repugnance to expose himself in the arena of literary intrigue, where he had, on a former occasion, wasted his time, and sacrificed his tranquillity, Halley, by repeated entreaties, at length succeeded in his object. On returning to London, Halley announced his success to the Royal Society, who repeated the request by means of Aston, at that time their secretary. But, though Newton kept his word to Halley, personally, by sending him a copy of his treatise, he did not then wish it to be communicated, having still many things to complete.* It was not till the following year, that Dr. Vincent presented, in Newton's name, this work, which was destined to make so great a revolution in science. Newton dedicated it to the Royal Society, who showed itself able to appreciate such an honour. It decided that the work should be printed immediately at its own expense, and addressed to the author, by Halley, a letter of thanks expressed in the most honourable terms.

Hooke, who probably had for some time past conceived in his mind similar ideas, without having been able to bring them to perfection, had no sooner understood the object of Newton's treatise, and heard of the admiration with which it was received, than he claimed for himself the priority of the discovery of the law of attraction varying inversely as the square of the distance. His reclamation was so violent, that Halley thought it necessary to notice it in his official letter to Newton, and to say that Hooke expected Newton to mention in his preface, that the priority was due to him. We will here quote the answer of

* Birch, Hist. R. S. vol. iv. p. 370.

Newton*, (dated Cambridge, 26th June, 1686,) especially as it will enable us to trace more clearly the progress and developement of his ideas throughout this important research.

"In order to let you know the case between Mr. Hooke and me, I give you an account of what passed between us in our letters, so far as I could remember; for 'tis long since they were writ, and I do not know that I have seen them since. I am almost confident by circumstances, that Sir Christopher Wren knew the duplicate proportion when I gave him a visit; and then Mr. Hooke, by his book Cometa, written afterwards (1678), will prove the last of us three that knew it. I intended in this letter to let you understand the case fully, but it being a frivolous business, I shall content myself to give you the heads of it in short, viz. that I never extended the duplicate proportion lower than to the superficies of the earth, and before a certain demonstration I found the last year, have suspected it not to reach accurately enough down so low; and therefore in the doctrine of projectiles never used it, nor considered the motion of the heavens, and consequently Mr. Hooke could not, from my letters, which were about projectiles, and the regions descending hence to the centre, conclude me ignorant of the theory of the heavens. That what he told me of the duplicate proportion was erroneous, namely, that it reaches down from hence to the centre of the earth—that it is not candid to require me now to confess myself in print then ignorant of the duplicate proportion in the heavens, for no other reason but because he had told it me in the case of projectiles, and so upon mistaken grounds accused me of that ignorance;—that, in my answer to his first letter, I refused his correspondence; told him I had laid philosophy aside, sent him only the experiment of projectiles (rather shortly hinted, than carefully described) in compliment, to sweeten my answer, expected to hear no further from him, could scarce persuade myself to answer his second letter, did not answer his third, was upon other things, thought no further of philosophical matters than his letters put me upon it, and therefore may be allowed not to have had my thoughts about me so well at that time. That, by the same reason, he concluded me ignorant of the rest of that theory I had read before in his books. That, in one of my papers, writ (I cannot say what year, but I am sure some time before I had any correspondence with Mr. Oldenburg, and that's above fifteen years ago) the proportion of the forces of the planets to the sun reciprocally duplicate to their distances from him, and the proportion of our gravity to the moon's *conatus recedendi a centro terræ* is calculated, though not accurately enough.—That, when Huygenius put out his treatise de Horologio Oscillatorio, a copy being presented to me, in my letter of thanks to him I gave those rules in the end thereof a particular commendation for their usefulness in computing the forces of the moon from the earth, and the earth from the sun, in determining a problem about the moon's phase, and putting a limit to the parallax, which shews that I had then my eye upon the forces of the planets arising from their circular motion, and understood it; so that a while after, when Mr. Hooke propounded the problem solemnly in the end of his *Attempt to prove the motion of the earth*, if I had not known the duplicate proportion before, I could not but have found it now. Between ten and eleven years ago, there is an hypothesis of mine registered in your books, wherein I hinted a cause of gravity towards the earth, sun, and planets, with the dependence of the celestial motions thereon; in which the proportion of the decrease of gravity from the superficies of the planet (though for brevity sake not there expressed) can be no other than reciprocally duplicate of the distance from the centre; and I hope I shall not be urged to declare in print that I understood not the obvious mathematical conditions of my own hypothesis; but grant I received it afterwards from Mr. Hooke, yet have I as great a right to it as to the ellipsis. For as Kepler knew the orb to be not circular but oval, I guessed it to be elliptical; so Mr. Hooke, without knowing what I have found out since his letters to me, can know no more but that the proportion was duplicate *quam proxime* at great distances from the centre, and only *guessed* it to be so accurately, and guessed amiss in extending that proportion down to the very centre; whereas Kepler guessed right at the ellipsis, and so Hooke found less of the proportion than Kepler did of the

* This letter is printed in the Biographia Britannica.—Art. Hooke.

ellipse, there is so strong an objection against the accurateness of this proportion, that without my demonstrations, to which Hooke is yet a stranger, it cannot be believed by a judicious philosopher to be anywhere accurate. And so, in stating this business, I do pretend to have done for the proportion as for the ellipse, and to have as much right to the one from Hooke and all men, as to the other from Kepler, and, therefore, on this account also, he must, at least, moderate his pretences. The proof you sent me I like very well: I designed the whole to consist of three books; the second was finished last summer, being short, and only wants transcribing, and drawing the cuts fairly. Some new proportions I have since thought of, which I can as well let alone. The third wants the theory of comets. In autumn last, I spent two months in calculations to no purpose, for want of a good method, which made me afterwards return to the first book, and enlarge it with divers propositions, some relating to comets, others to other things found out last winter. The third I now design to suppress. Philosophy is such an impertinently litigious lady, that a man had as good be engaged in lawsuits, as have to do with her. I found it so formerly, and now I am no sooner come near her again, but she gives me warning. The two first books, without the third, will not bear so well the title of *Philosophiæ Naturalis Principia Mathematica*; and, therefore, I had altered it to this, *De Motû corporum libri duo*; but, upon second thoughts, I retain the former title, 'twill help the sale of the book, which I ought not to diminish now 'tis yours."

Newton then adds, in a postscript, "Since my writing this letter, I am told by one who had it from another lately present at one of your meetings, how that Mr. Hooke should make a great stir, pretending I had all from him, and desiring they would see that he had justice done him. This carriage towards me is very strange and undeserved; so that I cannot forbear in stating the point of justice, to tell you further that he has published Borelli's hypothesis in his own name; and the asserting of this to himself, and completing it as his own, seems to me the ground of all the stir he makes. Borelli did something and wrote modestly. He has done nothing, and yet written in such a way, as if he knew, and had sufficiently hinted all but what remained to be determined by the drudgery of calculations and observations, excusing himself from that labour, by reason of his other business; whereas he should rather have excused himself by reason of his inability—for it is very plain, by his words, he knew not how to go about it. Now is not this very fine? Mathematicians that find out, settle, and do all the business, must content themselves with being nothing but dry calculators and drudges; and another that does nothing but pretend and grasp at all things, must carry away all the invention, as well of those that were to follow him, as those that went before. Much after the same manner were his letters writ to me, telling me that gravity in descent from hence to the centre of the earth was reciprocally in a duplicate ratio of the altitude—that the figure described by projectiles in that region would be an ellipsis, and that all the motions of the heavens were thus to be accounted for; and this he did in such a way, as if he had found out all, and knew it most certainly. And upon this information, I must now acknowledge, in print, I had all from him, and so did nothing myself but drudge in calculating, demonstrating, and writing upon the inventions of this great man; and yet, after all, the first of these three things he told me is false, and very unphilosophical; the second is as false; and the third was more than he knew, or could affirm me ignorant of, by anything that passed between us in our letters. Nor do I understand by what right he claims it as his own; for as Borelli wrote long before him, that, by a tendency of the planets towards the sun, like that of gravity or magnetism, the planets would move in ellipses: so Bullialdus wrote, that all force respecting the sun as its centre, and depending upon matter, must be in a reciprocally duplicate ratio of the distance from the centre, and used that very argument for it, by which you, Sir, in the last Transactions, have proved this ratio in gravity."

The remainder of this letter offering no other historical details, we will not continue the quotation; but the extremely curious reply of Halley to Newton is well worthy of attention. It is dated 29th June, 1686. Halley begins by encouraging Newton not to heed the effects of Hooke's expostulations with the Royal Society, and then continues:

"According to your desire, I waited upon Sir C. Wren, to inquire of him, if he had the first notion of the reciprocal duplicate proportion from Mr. Hooke? his answer was, that he himself, very many years since, had had his thoughts upon making out the planet's motions by a composition of a descent towards the sun and an impressed motion; but that at length he gave over, not finding the means of doing it. Since which time Mr. Hooke had frequently told him that he had done it, and attempted to make it out to him, but that he never was satisfied that his demonstrations were cogent. And this I know to be true, that in January, $168\frac{3}{4}$, I having, from the sesquialterate proportion of Kepler, concluded that the centripetal force decreased in the proportion of the squares of the distance reciprocally, came on Wednesday to town, from Islington, where I met with Sir C. Wren and Mr. Hooke, and falling in discourse about it, Mr. Hooke affirmed, that upon that principle all the laws of the celestial motions were to be demonstrated, and that he himself had done it. I declared the ill success of my attempts; and Sir Christopher, to encourage the inquiry, said, that he would give Mr. Hooke, or me, two months time to bring him a convincing demonstration thereof; and besides the honour, he of us that did it should have from him a present of a book of forty shillings. Mr. Hooke then said he had it, but that he would conceal it for some time, that others, trying and failing, might know how to value it, when he should make it public. However, I remember that Sir Christopher Wren was little satisfied that he could do it; and though Mr. Hooke then promised to show it to him, I do not find that, in that particular, he has been so good as his word. The August following, when I did myself the honour to visit you, I then learned the good news, that you had brought this demonstration to perfection, and you were pleased to promise me a copy thereof, which I received with great satisfaction; and thereupon took another journey to Cambridge, on purpose to confer with you about it, since which time it has been entered upon the register-books of the society. Mr. Hooke, according to the philosophically ambitious temper he is of, would, had he been master of a like demonstration, no longer have concealed it, the reason he told Sir Christopher and me now ceasing. But now he says that it is but one small part of an excellent system of nature, which he has conceived but has not yet completely made out; so that he thinks not fit to publish one part without the other. But I have plainly told him, unless he produce another differing demonstration, and let the world judge of it, neither I nor any one else can believe it. After the meeting of the Royal Society, at which your book was presented, being adjourned to the Coffee-house, Mr. Hooke did there endeavour to gain belief, that he had some such things by him, and that he gave you the first hint of this invention; but I found they were all of opinion that nothing thereof appearing in print, nor on the books of the Society, you ought to be considered as the inventor. And if in truth he knew it before you, he ought not to blame any one but himself, for having taken no more care to secure a discovery which he puts so much value on." Halley concludes, by conjuring Newton, in the name of science, not to suppress the third volume through disgust at the conduct of an envious rival. Happily he succeeded, and Newton has, in a scholium,* generously mentioned Wren, Hooke, and Halley, as having all three recognized in the celestial motions the existence of an attraction reciprocally proportional to the square of the distance.

Newton's *Principia* appeared complete in 1687. We may form some idea of the novelty and profundity of the discoveries which it contained, on learning that, when it was first published, not more than two or three among Newton's contemporaries were capable of understanding it; that Huygens himself, a man whose mind was particularly suited to appreciate its merit, only in part adopted the idea of gravitation, and that merely as regarded the heavenly bodies, while he rejected its influence between the separate particles of matter—being preoccupied by the hypothetical ideas he had formed respecting the cause of gravity; that Leibnitz, perhaps through rivalry, or perhaps by a prepossession in favour of his own metaphysical system, completely mistook the beauty and the certainty of the method employed by Newton in this work, and even went so far as to publish a dissertation, in which he endeavoured to demonstrate the same truths on different principles;

* Book 1, Prop. 4.

that even many years after the publication of the Principia, several most profound mathematicians (John Bernoulli, for instance) opposed it, and that Fontenelle, though in advance of his age on most subjects of philosophy, expressed somewhat more than doubts concerning the law of attraction, and persisted, during his whole life, in upholding the vortices of Descartes; and in fine, that more than fifty years elapsed before the great physical truth contained and demonstrated in the Principia was, we do not say followed up and developed, but even *understood* by the generality of learned men. Whatever difficulty, however, the just appreciation of such a work may present, we can here give a brief account of it with entire confidence, by translating the words of that illustrious man, whose genius has so much contributed to Newton's glory, in having by his own discoveries subjected *all* the movements of the celestial bodies to the law of universal gravitation. After having exhibited him as setting out from the laws of Kepler, in order to discover the nature and the law of the force that governs the motions of the planets and the satellites in their orbits, and afterwards generalizing this idea according to the phenomena that presented themselves until he had ascended to the certain and mathematical knowledge of universal gravitation, "Newton," says LAPLACE,* "having arrived at this point, saw all the great phenomena of the universe flow from the principle he had discovered. By considering gravity at the surface of the heavenly bodies as the result of the attractions of all their particles, he discovered this remarkable and characteristical property of a law of attraction reciprocal to the square of the distance, namely, that two spheres formed of concentric layers, and with densities varying according to any law whatever, attract each other mutually, as if their masses were united at their centres. Thus the bodies of the solar system act upon each other, and upon the bodies placed at their surfaces, very nearly as if they were so many centres of attraction—a result which contributes to the regularity of their movements, and which made this illustrious mathematician recognize the gravity of the earth in the force that retains the moon in her orbit. He proved that the earth's movement in rotation must have flattened it at the poles; and he determined the laws of gravitation in the degrees of the meridian, and in the force of gravity at the earth's surface. He saw that the attractions of the sun and moon excite and maintain in the ocean those oscillations which are there observed under the name of *tides*. He recognized several inequalities in the moon's motion and the retrograde motion of her nodes to be owing to the action of the sun. Afterwards, considering the excess of matter in the terrestrial spheroid at the equator, as a system of satellites adhering to its surface, he found that the combined actions of the sun and of the moon tend to cause a retrogradation, in the nodes of the circles they describe round the axis of the earth; and that the sum of these tendencies being communicated to the whole mass of the planet, ought to produce in the intersection of its equator with the ecliptic that slow retrogradation known by the name of the precession of the equinoxes. The true cause of this great phenomenon could not have even been suspected before the time of Newton, since he was the first who made known the two leading facts on which it depends. Kepler himself, urged by an active imagination to explain every thing by hypothesis, was constrained to avow in this instance the failure of his efforts. But, with the exception of the theory of the elliptical motions of the planets and comets, the attraction of spheres, the ratio of the masses of the planets accompanied by satellites to that of the sun, all the other discoveries respecting the motions and figures of the heavenly bodies were left by him in an incomplete state. His theory of the figures of the planets is limited, by supposing them to be homogeneous. His solution of the problem of the precession of the equinoxes, though very ingenious, and notwithstanding the apparent agreement of its result with observations, is defective in many particulars. Among the numerous perturbations in the motions of the heavenly bodies, he has only considered those of the moon, the greatest of which, viz. *evection*, has wholly escaped his researches. Newton has well established the existence of the principle he had the merit of discovering; but the development of its consequences and advantages has been the work of the successors of this great mathematician. The imperfection of the infinitesimal calculus when

* Exposition du Système du Monde, par Mons. le Compte LAPLACE. *Paris*, 1813. 4to. pp. 413, 426.

first discovered, did not allow him completely to resolve the difficult problems which the theory of the universe offers; and he was oftentimes forced to give mere hints, which were always uncertain till confirmed by rigorous analysis. Notwithstanding these unavoidable defects, the importance and the generality of his discoveries respecting the system of the universe, and the most interesting points of natural philosophy, the great number of profound and original views which have been the origin of the most brilliant discoveries of the mathematicians of the last century, which were all presented with much elegance, will insure to the Principia a lasting pre-eminence over all other productions of the human mind."

The great results that Newton has amassed in the Principia are almost all presented in a synthetical form, like that used in the writings of the ancients. Nevertheless we may assert, that he did not discover them by means of synthesis, which is neither sufficiently easy of application, nor sufficiently fertile in results to be employed in discovering such complicated truths, or for foreseeing consequences so remote from their first principle. It is hence evident, from this very impossibility, that Newton attained these great results by the help of analytical methods, of which he had himself so much increased the power; and this conclusion acquires certainty from the correspondence between Newton and Cotes, relating to the second edition* of the Principia, for in it we find Cotes, the pupil of Newton, employing the analytical form either in submitting to Newton the difficulties he met with, or in solving them himself. It remains to be explained why Newton preferred setting forth his discoveries by a different method, thus depriving himself of the increase of glory he would infallibly have obtained, by giving to the world the several analytical inventions with which he must have been acquainted in solving the questions he has treated. Among these we may mention the principle of the *calculus of variations*, which must have been necessary to him in determining the *solid of the least resistance*. It were difficult to say with certainty what decided him to make such a sacrifice, but if we may hazard a conjecture, it may not be impossible that, from the excessive apprehension which he laboured under of having his results attacked, he preferred the synthetical form, as being a severer method of demonstration, and as being likely to inspire more confidence in those who should read his work at a time when the methods of the infinitesimal analysis were still but little known; and when, from their novelty, they might appear less convincing to many of his readers. Whilst the Principia were preparing for the press, chance produced an incident that drew Newton from his studious retreat, and brought him on the theatre of public affairs. King James II. desiring to re-establish catholicism in England, and thinking fit to attack the usages and rights of the Protestants, had, among other measures, commanded* the University of Cambridge to confer the degree of M. A. on Francis, a Benedictine Monk, without requiring of him the oath prescribed by the statutes against the catholic religion. The University asserted its privileges; and Newton (who had shown himself one of the most ardent in encouraging resistance) was one of the delegates sent to maintain their rights before the High Commission Court. These delegates made so firm and unexpected a defence, that the king thought proper to drop the affair. It was this circumstance, perhaps, as much as the personal merit of Newton, that induced the University to elect him, the following year, as their representative to serve in the Convention Parliament, which declared the throne vacant, and called William to the crown. He sat in this parliament until its dissolution, but without acting a remarkable part. C. Montague, afterwards Earl of Halifax, was a member at the same time, and having been educated at Cambridge, was able to appreciate the merit of the genius who formed the glory of the University. Hence, when Halifax, having become Chancellor of the Exchequer, in 1696, conceived the design of a general recoinage, he demanded and obtained for Newton the honourable and lucrative employment of Warden of the Mint, which was at once an act of kindness, and a choice influenced by discernment. In fact, Newton rendered very signal service in executing the important measure which the statesman had determined on; being

* M. Biot examined this correspondence at Cambridge.

* Vide Burnet, History of his Own Time, vol. i. p. 698.

peculiarly fitted for the business by his singular mathematical and chemical knowledge. It appears that he had always taken great interest in chemistry; for, from the time when, as a child, he had lived with the apothecary at Grantham, till he resided at Cambridge, he had continued to occupy himself occasionally with that science. Of this we have a proof in his philosophical works, which are filled with profound chemical observations. In tracing the order of these labours, we find him, in his first researches about telescopes, in 1672, making a number of experiments on the alloys of metals, in order to discover the combinations most advantageous for optical purposes, and amassing in these essays a number of remarkable peculiarities in the constitution of bodies. Three years afterwards, the paper on the colours in thin plates affords us still more varied experiments on the combinations of different bodies, solid or liquid, with each other, and on the tendency or the repugnancy they have to unite; still later, the same subjects are treated with greater boldness and comprehensiveness in the Treatise on Optics, and particularly in the queries placed at the end of that admirable work; for what, *at that time*, could be bolder, than to assert that water must contain an inflammable principle, and that a similar one exists in the diamond?

Besides the natural charm a mind like Newton's must have felt, in the various astonishing and mysterious phenomena of chemistry, what additional interest must they have excited in him, when, having discovered the existence of molecular attraction, and the effects of actions exerted at small distances in the motion of light, he was led to see that similar forces, differing only in their law of decrease, or intensity, would be sufficient to produce in the ultimate particles of bodies all those phenomena of union and disunion, that constitute the science of chemistry! With these new and important phenomena, he occupied himself constantly at Cambridge; and, along with the study of chronology and history, they were the only relaxation he allowed himself when fatigued with his mathematical meditations. He had constructed a small laboratory for prosecuting such pursuits; and it would seem that, in the years immediately following the publication of the Principia, he devoted almost his whole time to them. But a disastrous accident deprived him, in an instant, of the fruits of so much labour, and lost them to science for ever.

Newton had a favourite little dog called "Diamond." One winter's morning, while attending early service, he inadvertently left this dog shut up in his room; on returning from chapel, he found that the animal, by upsetting a taper on his desk, had set fire to the papers on which he had written down his experiments; and thus he saw before him the labours of so many years reduced to ashes. It is said, that on first perceiving this great loss, he contented himself by exclaiming, "Oh, Diamond! Diamond! thou little knowest the mischief thou hast done." But the grief caused by this circumstance, grief which reflection must have augmented, instead of alleviating, injured his health, and, if we may venture to say so, for some time impaired his understanding. This incident in Newton's life, which appears to be confirmed by many collateral circumstances, is mentioned in a manuscript note of Huygens, which was communicated to M. Biot, of the French Institute, by Mr. Vanswinden, in the following letter:—

"There is among the manuscripts of the celebrated Huygens, a small journal in folio, in which he used to note down different occurrences; it is side Z., No. 8, page 112, in the catalogue of the library at Leyden: the following extract is written by Huygens himself, with whose hand-writing I am well acquainted, having had occasion to peruse several of his manuscripts and autograph letters.* *On the 29th May, 1694, a Scotchman of the name of Colin, informed me, that Isaac Newton, the celebrated mathematician, eighteen months previously, had become deranged in his mind, either from too great application to his studies, or from excessive grief at having lost, by fire, his chemical laboratory and some papers. Having made observations before the Chancellor of Cambridge,*

* The Latin words used by Huygens are as follows: "1694, die 29 Maii, narravit mihi D. Colin, Scotus, celeberrimum ac rarum geometram, Ism. Newtonum, incidisse in phrenitin abhinc anno ac sex mensibus. An ex nimiâ studii assiduitate, an dolore infortunii, quod in incendio laboratorium chemicum et scripta quædam amiserat. Cum ad archiepiscopum Cant. venisset, ea locutum quæ alienationem mentis indicarent; deindè ab amicis cura ejus suscepta, domoque clausâ, remedia volenti nolenti adhibita, quibus jam sanitatem recuperavit, ut jam nunc librum suum Principiorum intelligere incipiat."

*which indicated the alienation of his intellect, he was taken care of by his friends, and being confined to his house, remedies were applied, by means of which he has lately so far recovered his health as to begin to again understand his own Principia.* Huygens mentioned this circumstance to Leibnitz, in a letter, dated the 8th of the following June, to which the latter replied on the twenty-third. 'I am very happy that I received information of the cure of Mr. Newton, at the same time that I first heard of his illness, which, without doubt, must have been most alarming. It is to men like Newton and yourself, Sir, that I desire health and a long life.'"

This account by Huygens is corroborated by the following extract from a MS. at Cambridge, written by Mr. Abraham de la Pryne, dated Feb. 3, 1692, in which, after mentioning the circumstance of the papers being set fire to, he says, "But when Mr. Newton came from chapel, and had seen what was done, every one thought he would have run mad, he was so troubled thereat, that he was not himself for a month after." From these details, it would appear that the mind of this great man was affected, either by excess of exertion, or through grief at seeing the result of its efforts destroyed. In truth, there is nothing extraordinary in either of these suppositions; nor ought we to be astonished that the first sentiments arising from the great affliction which befell Newton were expressed without violence, for his mind was, as it were, prostrated under their weight. But the fact of a derangement in his intellect, whatever may have been the cause, will explain how, after the publication of the Principia, in 1687, Newton, though only forty-five years old, *never more* gave to the world a *new* work in any branch of science; and why he contented himself with merely publishing those that he had composed long before this epoch, confining himself to the completion of those parts that required development. We may also remark, that even these explanations appear in every case to be taken from experiments or observations previously made; as for instance, the additions to the second edition of the Principia in 1713, the experiments on thick plates, on diffraction, and the chemical queries placed at the end of the Optics, in 1704; for Newton distinctly announces them to be taken from manuscripts which he had formerly written; and adds, that though he felt the necessity of extending, or of rendering them more perfect, yet henceforth such subjects were no longer in his way.* Thus it appears, that though he had recovered his health sufficiently to understand all his researches, and even, in some cases, to make additions or useful alterations (as is shown by the second edition of the Principia, for which he kept up a very active mathematical correspondence with Cotes), yet he did not wish to undertake new labours in the department of science where he had done so much, and where he was so well able to conceive what remained to do. But whether this determination were imposed on him by necessity, or merely caused by a sort of moral weariness, the result of so long and severe an exercise of thought, what Newton had already done is sufficient to place him in the first rank of discoverers in every branch of pure and applied mathematics. After having admired him as almost the creator of Natural Philosophy, as one of the chief promoters of mathematical analysis, we must acknowledge, also, that to him we owe the first idea of mechanical chemistry; since he regarded its combinations as the result of molecular action, and by the boldest and most felicitous inductions raised himself to a conception of the composition and variation in the state of bodies, such as before his time was unknown and unthought of. Uniting so much theoretical and experimental knowledge, Newton must have been of the greatest service in superintending the melting down of the old coinage, which, from its worn and depreciated state, it was necessary to call in; and we find, accordingly, that in three years time (1699) he was recompensed for his services by the lucrative appointment of *Master of the Mint.* Hitherto, his means had been small† for his domestic wants. This new accession of fortune, however, did not render him unworthy of it; having gained it by merit, he maintained his title to it by the use he made of it. At this time, all the clouds had disappeared with which the spirit of jealousy had endeavoured to obscure his glory. He had raised himself too high to have a rival remain-

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* Vide Optics, end of second book.

† The estates of Woolsthorpe and Sustern were valued, at that period, at about 80l. per annum. He derived, also, some revenue from the university and from Trinity College.—Vide *Turner*.

ing, and due homage was paid from all quarters to his transcendent talents.

In 1699, the Académie des Sciences at Paris being empowered by a new Royal Charter to admit a very small number of foreign associates, hastened to make this distinction yet more honourable by enrolling on its lists the name of Newton. In 1701, the University of Cambridge again elected him to serve in Parliament.

In 1703, he was chosen President of the Royal Society of London, a title which renders the person on whom it is conferred, as it were, the public representative of philosophy and science, and gives to him an influence the more useful, because it proceeds from voluntary confidence. Newton was annually re-elected to this honourable office, and continued to fill it during the remainder of his life (a period of twenty-five years); and finally, in 1705, he was knighted by Queen Anne. He now determined to publish himself, or to allow others to publish, his different works. He first gave to the world his Optics, a treatise which comprises all his researches on light. It would appear that, fatigued with the petty attacks that his ideas on these subjects had drawn upon him (in 1672-5), Newton had resolved not to publish this work during the life of Hooke; the latter, however, died in 1702, and the jealous influence he had been able to exercise had previously expired. Newton, having no longer any fear of controversy, did not delay publishing these discoveries, which, though of a different description, and of a less general application than those which the world had admired in the Principia, are not inferior to them in the originality of their conception.

When the Optics appeared, in 1704, it was written in English. Dr. Samuel Clarke, afterwards so celebrated for his controversies with Leibnitz, published a Latin version in 1706, with which Newton was so satisfied, that he presented the translator with 500*l.* as a testimony of his acknowledgment; many editions of the work itself, and of the translation, rapidly succeeded each other, both in England and on the continent. Although the number of editions shows how much this treatise has from that time been admired, yet its whole merit has not been fully appreciated till within these few years, when new discoveries, and particularly that of the polarization of light, have rendered perceptible all the importance of certain very delicate phenomena, whose general existence Newton had pointed out in the propagation of light, and which, under the names of "fits of easy transmission and reflection," he considered as essential attributes of that principle. These properties being so subtile, that they escape all observations which are not extremely exact, and being at the same time so singular that, in order to admit them, it is necessary to have the fullest conviction of the accuracy of the experiments which establish them, they were, for a long period, regarded merely as ingenious hypotheses; and it has even been thought in some degree necessary to apologize for Newton's having mentioned them. But, in the present day, it is generally acknowledged that these properties, with the laws assigned to them by Newton, are modifications really and incontestably inherent in light, though their existence must be differently conceived and applied, according to the hypothesis we adopt as to the nature of the luminous principle.

To the first edition of the *Optics*, Newton added two analytical treatises, the one entitled "*Enumeratio linearum tertii ordinis*," and the other, "*Tractatus de quadratura curvarum*." The latter contains an explanation of the method of fluxions, and its application to the quadrature of curves, by means of expansion into infinite series; and the first a very elegant classification of curves of the third order, with a clear and rapid enumeration of their properties, which Newton probably had discovered by the method of expansion, enunciated in the former treatise; though he merely indicates the results, without mentioning the process which he had employed in investigating them. These two treatises were withdrawn from the following editions of the *Optics*, with the subject of which they were not sufficiently connected; but we may presume that Newton's object in inserting them in the edition of 1704 was to insure his right to the discovery and application of those new analytical methods, which, after having been so long in his secret, and as he supposed, sole possession, had now for several years been making their way with much success on the continent, and were there producing new and important results in the hands of foreign analysts, particularly of Leibnitz, and the Bernoullis.

The great renown which Newton had acquired, caused all his productions to be received with avidity. Hence it was that Whiston published in 1707, without the knowledge or consent of Newton, the "*Arithmetica universalis*," which appears to have been merely the text of the lectures on Algebra, that he delivered at Cambridge, written rapidly for his own use, and not intended for publication. Science, however, must congratulate itself on the transgression of confidence that has fortunately made this work known; for it were impossible to see a more perfect model of the art by which geometrical or numerical questions may be submitted to algebraical calculation; whether we regard the happy choice of the unknown quantities, or the ingenious combination of analytical formulæ, employed in finding the simplest method of solution. A second and more complete edition was published in London in 1712, according to Gravesande, with the participation of Newton himself—a proof that this production of his youth appeared to him neither unworthy of his name nor of his attention.

It was also, by the care of some other editor, but with his consent, that in 1711 a small treatise, entitled "*Methodus differentialis*," was published, in which he shows how to draw a *parabolic curve* through any given number of points—a determination which, when reduced into formulæ, is very useful in the interpolation of series, and in approximating to the quadratures of curves.

In the same year, by other hands, was published the long-suppressed treatise, "*Analysis per equationes numero terminorum infinitas*," which he had composed in 1665, and in which, as we have already said, he had explained his first discoveries in fluxions, and in expansions, by means of infinite series. A copy of this dissertation had formerly been taken by Collins, from the original sent to him by Barrow; and having been found among his papers after his death, leave was obtained from Newton to publish it—a permission which he probably gave the more willingly, as the work being of old date, incontestably established his claims to the invention of the new method.

Newton formerly had prepared, on the same subject, a more extensive treatise, entitled "*A method of Fluxions*," which he proposed to join as an introduction to a treatise on algebra, by Kinckhuysen, of which he had undertaken to publish an edition in 1672: this, without doubt, would have been more valuable than the book itself, but his fear of scientific quarrels induced him then to keep his manuscript secret. Towards the close of his life, he again thought of publishing it, but it was not printed till after his death. The same apprehension had, as we have already said, prevented him from publishing his "Optical Lectures" delivered at Cambridge. Happily, however, he had entrusted copies to many persons, and among others, to Gregory, professor of astronomy at Oxford, one of which being printed three years after his death, has preserved to us this work. It presents a very detailed experimental exposition of the phenomena of the composition and decomposition of light, with their most usual applications: it is, in fact, the *Optics* without the most difficult part, viz. the theory of colours produced by thin plates; but, in the other parts, fully developed both by calculations and by numerous experiments. In this form, it was extremely proper for the use to which Newton intended it, and at this day it offers a most valuable model for an elementary exposition of phenomena by experiment.

Here would terminate our account of the works on which the fame of Newton reposes, had not a new literary dispute (about 1712), which, in fact, he did not provoke, and the existence of which, perhaps, he more than once regretted, completely revealed all the fertility of his wonderful genius, and assembled a multitude of analytical discoveries, which we find in the correspondence that ensued. We have seen that Newton, for a long time, obstinately guarded the secret of his discoveries, and particularly that of the method of fluxions, of which he justly foresaw the future utility in calculating the phenomena of nature. However, in 1676, Leibnitz having heard of the new results that Newton was said to have obtained by means of infinite series, testified to Oldenburg the desire he felt to become acquainted with them. The latter induced Newton not to refuse a communication which could not but be honourable to him. In consequence (23rd of June, 1676), Newton sent to Oldenburg a letter to be transmitted to Leibnitz, in which he gave expressions for the expansion in series of binomial powers, of the sine in terms of the arc, of the arc

in terms of its sine, and of elliptical, circular, and hyperbolic functions, without, however, any demonstration or indication of the means he had used for obtaining these results; merely stating that he possessed a method by which, when these series were given, he could obtain the quadratures of the curves from which they were derived, as well as the surfaces and centres of gravity of the solids formed by their rotation. This may in fact be done by considering each term of these series as the ordinate of a particular curve, and by then applying the method previously given by Mercator, for squaring curves, of which the ordinates are expressed rationally in terms of the abscissa. This is precisely what Leibnitz remarked in his answer to Newton on the 27th of the following August, adding that he should be glad to know the demonstration of the theorems on which Newton founded his method of reducing into series; but that, for himself, though he recognized the utility of this method, he employed another, which consisted in decomposing the given curve into its superficial elements, and in transforming these infinitely small elements into others, equivalent to them, but belonging to a curve whose ordinate was expressed rationally in terms of the abscissa, so that the method of Mercator might be applied in squaring it. After giving different explanations of this method, he declares in express terms that he does not believe that "all problems, except those of Diophantes, can be resolved by it alone, or by series," as Newton had affirmed in his letter; and among the problems which elude these processes, he mentions the case of finding curves from their tangents; adding that he had already treated many questions of this sort by means of a direct analysis, and that the most difficult had been thus solved. This was more than enough to show Newton that Leibnitz was at least upon the track of the infinitesimal calculus, if he did not possess it already; and, therefore, in his answer (dated Oct. 24th, though apparently delivered to Leibnitz much later), after giving the explanations requested by Leibnitz on the formation of binomial series, and after stating to him the succession of ideas, by means of which he had discovered them, Newton hastens to declare that he possesses for drawing tangents to curves a method equally applicable to equations, whether disengaged or not of radical quantities; "but," he adds, "as I cannot push further the explication of this method, I have concealed the principle in this anagram."*

He announced that he had established on this foundation many theorems for simplifying the quadrature of curves, and gave expressions for the areas in terms of the ordinates in several simple cases; but he enveloped both the method and the principle on which it rested in another anagram more complicated than the first.

The evident object of Newton, in this letter, was to place his claims to priority of invention in the hands of Leibnitz himself. The noble frankness of Leibnitz appears on this occasion to the greatest advantage: for in his answer to Newton (21st of June, 1677) he employs neither anagram nor evasion, but details simply and openly the method of the infinitesimal calculus, with the differential notation, the rules of differentiation, the formation of differential equations, and the applications of these processes to various questions in analysis and geometry; and, what mathematicians will consider as far from being unimportant, the figures employed in the exposition of these methods offer precisely the same letters, and the same method of notation, that Leibnitz had used in his first letter of the 14th of April the preceding year. Newton made no reply to this memorable letter, either because he no longer felt the wish, or because, from Oldenburg's death, (which happened in the autumn of the same year,) he had no longer an opportunity of doing so.

Leibnitz published his differential method in the Leipzig Acts for 1684, in a form exactly similar to that which he had sent to Newton. No claim was set up at that time to contest his right of discovery, and Newton himself, *three years afterwards*, eternalized that right by recognizing it in the Principia, in the following terms.† "In a correspondence which took place about ten years ago, between that very celebrated mathematician G. Leibnitz and myself, I mentioned to him that I possessed a method (which I concealed in an anagram) for determining maxima and

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* The letters composing the anagram formed the following sentence—*datâ equatione quotcumque fluentes quantitates involvente, fluxiones invenire, et vice versâ.*

† Scholium, Prop. vii. Lib. 2.

minima, for drawing tangents, and for similar operations, which was equally applicable both to rational and irrational quantities: that illustrious man replied that he also had fallen on a method of the same kind (*se quoque in ejusmodi methodum incidisse*), and communicated to me his method, which scarcely differed from mine, except in the notation and the idea of the generation of quantities."

There is a curious ambiguity in the words, "*he replied that he had fallen on a method of the same kind*," which, to those who had not seen the letters that were interchanged, might convey the idea, that Leibnitz had discovered the key to Newton's anagram; but this meaning is not to be found in Leibnitz's letter; he only announces a supposition, honourable to his character, viz. that the concealed method of Newton has, perhaps, some connexion with that which he communicates to him. With this explanation, the above passage in the Principia is in truth a formal recognition of Leibnitz's claims. It was so considered by every one when it appeared, and during twenty years Leibnitz was allowed, without any dispute, to develope all the parts of the differential calculus, and to deduce from it an immense number of brilliant applications, which seemed to extend the power of mathematical analysis far beyond any preconceived limits. In this interval, Wallis, by publishing the above-mentioned letters between Leibnitz and Newton, only rendered, if possible, the claims of the former more complete and more incontestable in the eyes of every impartial person. It was not till 1699 that Nicholas Fatio de Duillier,* in a Memoir, in which he employed the infinitesimal calculus, claimed, in favour of Newton, the first invention of it; "and," added he, "with regard to what Mr. Leibnitz, *the second* inventor of this caculus may have *borrowed* from Newton, I refer to the judgment of those persons who have seen the letters and manuscripts relating to this business." Did Fatio really believe what he was writing, or did he wish to flatter the national pride of the country in which he lived? or was he not in some manner irritated at Leibnitz having rendered so little justice to the Principia, and at his appearing to arrogate to himself a sort of empire over all discoveries made by the aid of the new calculus? These questions we do not pretend to decide; but the two latter suppositions are the most probable. Leibnitz replied, by stating the facts, and quoting his letters, and the testimony rendered to him by Newton himself. Fatio was silent; and thus the matter stood till 1704, when Newton published the Optics. In giving an account of the *treatise on the quadrature of curves*, which was joined to this work, the editor of the Leipzig Acts naturally mentioned the evident analogy that existed between Newton's method of fluxions and the differential calculus which had been published twenty years previously by Leibnitz, in the same Acts, and which had since become the means of making an infinity of analytical discoveries. In comparing the two methods, the editor (whom Newton supposes to have been Leibnitz himself) did not precisely say, that the method of fluxions was a mere transformation of the differential calculus; but he used terms which might bear such an interpretation. This was the signal for attack, on the part of the English writers: one of the most violent of them, Keil, professor of astronomy at Oxford, said, in a paper printed in the Philosophical Transactions, not only that Newton was the first inventor of the method of fluxions, but also that Leibnitz had stolen it from him, by merely changing the name and the notation used by Newton. This produced an indignant reply from Leibnitz, who had the imprudence to submit the question to the judgment of the Royal Society, that is to say, of a tribunal which was presided over by his rival. The society, with scrupulous fidelity, collected all the original letters that could be found bearing on the matter in question, and thus, with regard to the facts, its conduct was unimpeachable; but the most important and delicate part of the business, viz. the discussion of those papers, and the consequences to be deduced by them, it referred to arbitrators chosen by itself, who were not known, and about whose appointment Leibnitz was *not* consulted. These arbitrators decided that Newton had indubitably been the first discoverer of the method of fluxions, a truth which is certainly incontestable in the sense that discovery and invention are synonimous terms; but they also added two assertions, which can only be considered as the expression of their personal opinion—first, that the *differential* and

* A Genevese settled in England.

*fluxional* methods are one and the same thing; and, secondly, that Leibnitz *must* have seen a letter of Newton's, (dated 10th December, 1672,) in which the method of fluxions is described in a manner sufficiently clear for any intelligent person to understand. Now of these two assertions, the second is not proved in any one of its parts, and the letter of Newton alluded to, appears, according to his custom, to have been more intended for establishing his right, than proper for indicating the manner of attaining his method. With regard to the first assertion, that the methods are absolutely identical, it may easily be refuted by the simple consideration, that if the method of fluxions alone existed at the present moment, the invention of the differential calculus with its notation, and its principle of decomposition into infinitely small elements, would still be an admirable discovery, and one which would immediately bring to light a number of applications, which we now possess, but which probably would not have been obtainable without its assistance. Admitting then, as certain, the priority of Newton's ideas on this subject, we think that the reserve he maintained regarding it left the field open to all other inventors; and that from the general tendency of the mathematical researches of that period, both Leibnitz and Newton might have separately arrived by different means at the knowledge of a method, the want of which was then so sensibly felt in all analytical researches. The quarrel between Newton and Leibnitz has not been without advantage to mathematical science; since it produced the precious collection of letters on infinitesimal analysis, collected by the Royal Society, and published in 1712, under the name of the *Commercium Epistolicum.* But as regards these two great men themselves, the bitterness with which it inspired the one against the other, became the torment and the misfortune of the remainder of their lives. Newton went so far as to affirm, that Leibnitz had deprived him of the differential calculus, and then that this calculus was identical with Barrow's method of tangents: an assertion of which he could not but have perceived the injustice, since, if he pretended, on the one hand, that the differential calculus and the method of fluxions were the same, he must have also admitted the method of fluxions to be identical with Barrow's method of tangents, an assertion which he was far from admitting. Newton suffered himself to be carried away so far as to pretend that the paragraph inserted in the Principia, by which he had so openly acknowledged the independent rights of Leibnitz, was by no means intended to render him that testimony, but, on the contrary, to establish the priority of the method of fluxions over that of the differential calculus. Newton's animosity was not even calmed by the death of Leibnitz, in 1716: for he immediately afterwards printed two manuscript letters of Leibnitz, written in the preceding year, accompanied with a bitter refutation. Six years later, (in 1722) he caused a new edition of the Commercium Epistolicum to be printed, at the head of which he placed a very partial extract from this Collection. This was apparently made by himself, and had already appeared two years before the death of Leibnitz, in the Philosophical Transactions for 1715. Finally, Newton had the weakness to leave out, or allow to be left out, in the third edition of the Principia, published under his own inspection, 1725, the famous Scholium, in which he had admitted the rights of his rival. To render such conduct, not to say excusable, but even comprehensible, on the part of a man who must so well have known that the only tribunal that can decide on such causes is impartial posterity, it is necessary to say that Leibnitz, on his side, had neither been less passionate nor less unjust. Hurt by the unexpected publication of the Commercium Epistolicum, and irritated by a decision, given without his knowledge, by judges whom he had not appointed, and who had not waited for his defence, he summoned contrary testimonies in his support. Leibnitz had the misfortune to produce proofs equally exaggerated with those brought forward by Newton. He printed, and spread throughout Europe, an anonymous letter (since discovered to have been written by J. Bernoulli), extremely injurious to Newton, whom it represented as having fabricated his method of fluxions from the differential calculus. Leibnitz committed a still greater fault. He was in the habit of corresponding with the Princess of Wales, daughter-in-law to George the First. This princess, endowed with a highly cultivated mind, had received Newton with extreme kindness, and was fond of conversing with him. She declared that she esteemed

herself happy in living at a time that enabled her to become acquainted with so great a genius. Leibnitz made use of his correspondence with the princess, to lower Newton in her eyes, and to represent his philosophy to her not only as physically false, but also as dangerous in a religious point of view; and, what is still more inconceivable, he founded these accusations on passages in the *Principia*, and in the *Optics*, which Newton had evidently composed and inserted with intentions sincerely religious, and as genuine professions of his firm belief in a divine Providence. For instance, in explaining the true method to be pursued in natural philosophy, Newton says, in his Twenty-eighth Query, "the main business of this science is to argue from phenomena, without feigning hypotheses, and to deduce causes from effects, till we come to the very First Cause; which certainly is not mechanical: and not only to unfold the mechanism of the world, but chiefly to resolve these and such like questions. What is there in places almost empty of matter, and whence is it, that the sun and planets gravitate towards one another, without dense matter between them? Whence is it that nature doth nothing in vain, and whence arises all that order and beauty, which we see in the world? To what end are comets, and whence is it that planets move all one and the same way, in orbs concentric, while comets move all manner of ways in orbs very eccentric; and what hinders the fixed stars from falling upon one another? How came the bodies of animals to be contrived with so much art? and for what ends were their several parts? was the eye contrived without skill in optics, and the ear without knowledge of sounds? How do the motions of the body follow from the will, and whence is the instinct in animals? Is not the sensoryof animals that place to which the sensitive substance is present; and into which the sensible species of things are carried through the nerves and brain, that there they may be perceived, by their immediate presence to that substance? And these things being rightly dispatched, does it not appear from phenomena, that there is a Being incorporeal, living, intelligent, omnipresent, who in infinite space, as it were, in his sensory, sees the things themselves intimately, and thoroughly perceives them, and comprehends them wholly by their immediate presence to himself; and which things, the images only, carried through the organs of sense into our little sensoriums, are there seen and beheld, by that which in us perceives and thinks; and though every true step made in this philosophy bring us not immediately to the knowledge of the First Cause, yet it brings us nearer to it, and on that account is to be highly valued?"

It is thus that Newton speaks of a Supreme Being; and even those who might dispute the arguments which he gives for such an existence, must still recognize, in this passage, the sentiments of a mind deeply imbued with religious feelings, and convinced of their true foundation. It was upon this ground, however, that Leibnitz attacked him in his correspondence with the princess: "it appears," says he, in one of his letters, "that natural religion is diminishing extremely in England;" and he cites as a proof the works of Locke, and the above passage from Newton; elsewhere he says, "that these principles are precisely those of the materialists." When we see a mind of the order of that of Leibnitz expressing itself with such blind contempt for the grand and incontrovertible discovery of universal gravitation, and employing such arguments in objecting to it, we are disposed to compassionate the occasional weakness of the finest intellects, and to deplore the petty passions which tarnish the splendour of genius. The rank of the person to whom this accusation was addressed increased its importance in those days. The king was informed of the matter, and expressed his expectation that Newton would reply. It would appear that it was this authority that determined Newton personally to enter the lists; but he only undertook the defence of the mathematical part of the question; the philosophical part he left to Dr. Clarke, who, though inferior as a mathematician, was a better metaphysician than himself. From this resulted a great number of letters, written by Clarke and Leibnitz to each other, which were all inspected by the princess. In the course of this correspondence, as often happens, the original question was lost amidst collateral disquisitions.* On reading these letters, it must excite surprise that a woman of rank could amuse herself with discussions of this sort,

* These letters were published in France by Des maizeaux.

mixed up as they were with the coarse and erudite jests made use of by Leibnitz. To this taste, however, of the princess for serious matters we owe our acquaintance with a work of Newton, very different from those that we have hitherto mentioned. Conversing one day on some historical subject, Newton explained to her a system of chronology, which he had formerly composed, simply for amusement. The princess was so much pleased with it, that she requested a copy, *for her own use*, on which latter condition Newton complied with her request: he, however, gave also a copy to the Abbé Conti, who had made himself remarkable by interfering in the disputes between Leibnitz and Newton. No sooner was the Abbé in Paris, than he communicated this manuscript to the world. It was immediately translated and printed, not only without the consent or knowledge of Newton, but even accompanied with a refutation by Fréret. Newton had thus the mortification to hear at the same time of the publication and reply, without having had any suspicion of the transaction; and was hence obliged, though contrary to his original intention, at least to give a more correct edition; but he was only able to prepare one: it did not appear till after his death in 1728.

This leads us to speak of another work of Newton, which, though appearing to differ much in its title from the one we have just mentioned, is, like it, an historical memoir; the title is, "*Observations upon the Prophecies of Holy Writ, particularly the Prophecies of Daniel and the Apocalypse of St. John.*" Notwithstanding the singularity such a subject appears to offer, when treated of by a mind like that of Newton, we venture to affirm, that more persons have spoken of this dissertation than have given themselves the trouble to read it; it therefore becomes our duty here to point out more particularly the object which Newton had in view, and his manner of proceeding. The groundwork of his reasoning is concisely expressed by the following words in the work itself:*—

"The folly of interpreters hath been to foretell times and things by this prophecy, as if God designed to make them prophets. By this rashness they have not only exposed themselves, but brought the prophecy also into contempt. The design of God was much otherwise. He gave this and the prophecies of the Old Testament, not to gratify men's curiosities, by enabling them to foreknow things; but that after they were fulfilled, they might be interpreted by the event; and his own Providence, not the interpreters', be then manifested thereby to the world. Now," says Newton, "for understanding the prophecies, we are in the first place to acquaint ourselves with the figurative language of the prophets; this language is taken from the analogy between the world natural and an empire or kingdom considered as a world politic."* He then successively enters into all the details of this connexion; first of all considering the heavens and the earth as representing thrones and people; then taking the astronomical phenomena, the rain, the hail, the meteors, the animals, the vegetables, their different parts, their different actions, and those of man himself; and finally, every thing in the material world, as having a peculiar mystic signification which he fixes and defines: "for instance," says he, "when a beast or man is put for a kingdom, his parts and qualities are put for the analogous parts and qualities of the kingdom: as the head of a beast for the great men who precede and govern; the tail for the inferior people who follow and are governed; the heads, if more than one, for the number of capital parts, or dynasties or dominions in the kingdom, whether collateral or successive, with respect to the civil government; the horns on any head for the number of kingdoms in that head, with respect to military power; seeing for understanding and policy; and in matters of religion for επισκοποι, bishops; speaking for making laws; the mouth for a lawgiver, &c. &c." † Down to this point we find, in fact, nothing new, except the precise and, in some degree, systematic explanation of the method of interpretation: for at bottom this method is that which has been employed by all commentators; and it is really impossible to employ any other, in applying a prophecy which is not explicit in its terms. The distinguishing character of Newton's work is, that having thus made his glossary beforehand, it often suffices him for explaining a prophecy, to place the figu-

* Age of Apocalypse.

* Prophecies, part 1. chap. 2.

† Prophecies, part 1. chap. 2. p. 8.

rative terms word for word opposite to the explanations: by these means he makes a quicker and more extended progress. We will not follow him in the vast career he proposed to go over. Furnished with what he considered a key to prophetical language, he successively questions Daniel and St. John, and endeavours to produce, from their prophecies, the historical events that have taken place since their time. His work is immense; it embraces not only the principal epochs, and the most important events, in the ancient and in a part of the middle ages, but also a multitude of particular facts, of chronological observations, and of researches on civil or ecclesiastical antiquities, showing deep and extensive knowledge, taken from the most authentic sources. To give an idea of the detailed applications by which Newton has allowed himself to be carried away in this singular composition, and at the same time not to leave unnoticed the spirit of prejudice of which unhappily it bears the stamp, we will extract a passage in the seventh and eighth chapters of the first part. Newton has explained the ten horns of the fourth beast of Daniel by the ten kingdoms which the barbarians founded on the ruins of the Roman empire in the west, and has rapidly traced the history of each of these kingdoms, in order to show how it agrees with the prophecies. It remains to explain the eleventh horn of the same beast: the words of scripture are: "Now Daniel considered the horns, and behold there came up among them another horn, before whom there were three of the first horns plucked up by the roots; and behold in this horn were eyes like the eyes of a man, and a mouth speaking great things, and his look was more stout than his fellows, and the same horn made war with the saints, and prevailed against them: and one who stood by, and made Daniel know the interpretation of these things, told him, that the ten horns were ten kings that should arise, and another should arise after them and be diverse from the first, and he should subdue three kings, and speak great words against the Most High, and wear out the saints, and think to change times and laws: and that they should be given into his hands until a time and times and half a time." "Now," says Newton, "kings are put for kingdoms as above; and therefore the little horn is a little kingdom. It was a horn of the fourth beast, and rooted up three of his first horns; and therefore we are to look for it among the nations of the Latin empire, after the rise of the ten horns. But it was a kingdom of a different kind from the other ten kingdoms, having a life or soul peculiar to itself, with eyes and a mouth. By its eyes it was a seer; and by its mouth speaking great things, and changing times and laws, it was a prophet as well as a king. And such a seer, a prophet, and a king, is the church of Rome." Newton then supports this analogy by an historical account of the rise and progress of the papal power, the details of which he, in succession, compares with the prophecy. Newton carries this investigation *no further* than the last half of the eighth century, because," says he, "the Pope, by acquiring temporal power, is clearly designated by the prophet:" but carried beyond the limits previously assigned by himself to interpreters, he goes on to predict the epoch of the fall, or at least decline of this temporal power, for translating the expression of Daniel, "a time and times and half a time," by 1260 solar years, and indicating the year 800 as about the point to count from, he fixes the fatal term to be about the year 2060. We must remark, that this conclusion is not, in his work, as in those of some other protestant writers, dictated by any sectarian or party feeling; he states it with all the calm of entire conviction, and with all the simplicity of an evident demonstration. It appears to be not Newton, but St. John and Daniel, who attack the power of modern Rome, who characterize it by injurious terms, and finally predict its ruin.

It will, doubtless, be asked, how a mind of the character and force of Newton's, so habituated to the severity of mathematical considerations, so accustomed to the observation of real phenomena, so methodical, and so cautious, even at his boldest moments in physical speculation, and consequently so well aware of the conditions by which alone truth is to be discovered, could put together such a number of conjectures, without noticing the extreme improbability that is involved in all of them, from the infinite number of arbitrary postulates on which he endeavours to establish his system. The answer to this question must be taken entirely from the ideas and the habits of the age

in which Newton lived. Not only was Newton profoundly religious, but his whole life was spent, and all his affections were concentrated in a circle of men, who, holding the same doctrines, considered themselves bound by their station or profession to defend and propagate them. The English philosophers of that period took pleasure in combining the researches of science with theological discussion; to which they were the more inclined, because the cause of protestantism had identified itself with political liberty; and men studied the bible to find weapons against despotism. The choice of Newton by the University of Cambridge as one of the delegates sent to King James, shows clearly that he shared in such sentiments; nor is it a more surprising fact, that Newton wrote upon the Apocalypse, than that R. Boyle, one of the greatest natural philosophers of the same period, published a treatise, entitled "The Christian Virtuoso," of which the object is to show that experimental philosophy conduces to a man being a good Christian,—than that Wallis, the celebrated mathematician, composed a number of tracts on religious subjects,—than that Barrow who reckoned Newton himself among his pupils, and who resigned in his favour the mathematical chair, consecrated his latter years to theology, in order to take the degree of doctor in that faculty—that Hooke, whom we have so often mentioned, composed a work on the Tower of Babel—that Whiston, Newton's pupil and successor at Cambridge, also composed an essay "on the Revelation of St. John," and other treatises on pure theology—that Clarke, another still more illustrious pupil of Newton, the faithful translator of his Optics, the zealous promoter and ingenious defender of his philosophy, was at the same time the most profound theologian and sublime preacher in England; and finally, that Leibnitz himself, to take no other example, in the course of his literary life, voluntarily made numerous excursions into the provinces of natural theology, revelation, and biblical criticism; that he commented on the story of Balaam, treated in various ways the question of grace, and with the laudable intention of uniting Protestants and Catholics, discussed with Bossuet the principal doctrinal points which separate the two churches. This alliance of the exact sciences with religious controversy, at that time so general, is the natural mode of accounting for the theological researches of Newton, however singular they might appear at the present day. There is another tract belonging to the same class of writings, which we must also mention, not only from the importance of the subject in a religious point of view, but also because it affords us a new opportunity of seeing the extensive knowledge which Newton possessed in these matters. The title is "*An historical account of two notable corruptions of the Scriptures*," in fifty pages 4to.; it contains a critical discussion of two passages in the Epistles of St. John and St. Paul, relating to the doctrine of the Trinity, which Newton supposes to have been altered by the copyists. From the nature of the subject, and from certain indications at the beginning of the pamphlet, it probably was composed when the works of Whiston and of Clarke on the same subject drew upon them the attacks of all the English theologians, that is, about 1712-13. It is certainly very remarkable that a man of the age of seventy-two or seventy-five should be able to compose rapidly, as he himself insinuates, so extensive a piece of sacred criticism, and of literary history, in which the logically connected arguments are always supported by the most varied erudition. At this period of Newton's life, the reading of religious works had become one of his most habitual occupations; and after he had performed the duties of his office, they formed, along with the conversation of his friends, his only amusement. He had now almost ceased to think of science, and as we have already remarked, since the fatal aberration of his intellect in 1693, he gave to the world only three really new scientific productions. One of these had probably been prepared some time previously, and the other must have occupied but little time: the first, published in the Philosophical Transactions, consists of only five, though very important, pages. It contains a comparative scale of temperatures, from the point of melting ice to that of the ignition of charcoal; the lower degrees are observed by means of a thermometer of linseed oil, the scale of which is divided into equal parts; the zero corresponds to the melting point of ice, and the 81st degree to the melting point of tin. The higher degrees are calculated according to the law of cooling in a metallic mass, by supposing the instan-

taneous decrease in temperature to be proportional to the temperature itself, and by observing the time of the arrival of the fluid at each degree of temperature intended to be marked. These two methods of observation are connected by applying them to the same temperature—for instance, to the fusion of tin, which is the highest in the one series, and the lowest in the other.

We have thus in this paper three important discoveries—first, a method of comparing thermometers, by determining the extreme terms of their scale from phenomena taking place at *constant temperatures*—secondly, the determination of the laws of cooling in solid bodies at slightly elevated temperatures; and thirdly, the observation of the constancy of temperature in the phenomena of melting and boiling—a constancy which has since become one of the foundations of the modern theory of heat: this important fact is established in Newton's treatise, by numerous and various experiments, made not only on compound bodies, and the simple metals, but on various metallic alloys, which shows us that Newton clearly perceived their importance. There is reason to believe that this paper was one of those composed before the fire in his laboratory.

The second paper we must mention, also dated 1700, was communicated by Newton to Halley, and was a plan for an instrument of reflection to observe with at sea, without the observer being disturbed by the motion of the ship. It has been pretended that this idea, since so generally and so usefully employed by navigators, had been invented a long time previously by Hooke. It is true that in the history of the Royal Society for 1666, there is mentioned an instrument proposed by Hooke, to measure angles by means of the reflection of light; this announcement, however, is unaccompanied by any description to enable us to judge of the nature of the instrument; and if we endeavour to supply this defect by consulting the works of Hooke, written after this period, we shall find, that though he often makes use of reflection, it is always when applied to *large fixed instruments*; an idea which has no relation to that of employing reflection in *moveable instruments*, in order to render the angular distance of remote objects under observation independent of small changes of place in the centre of observation from which they are viewed. There is no reason to believe that any one formed this happy and important idea before Newton, though the inexplicable silence of Halley, with regard to Newton's letter to him, left to another man, *Hadley*, the honour of again conceiving it (in 1731), and of so happily executing it, that mariners have given the name of *Hadley's Quadrant* to this ingenious and useful invention.

The last labour of Newton that remains to be mentioned, was of another sort, and composed on a totally different occasion. In 1696, J. Bernoulli proposed to the mathematicians of Europe, to discover a curve, down which a heavy body should descend in the quickest time possible, between two given points at unequal heights. Newton having received this problem, presented on the next day a solution of it, but without any demonstration, merely saying that the required curve must be a cycloid, for the determination of which he gave a method. This solution appeared anonymously in the Philosophical Transactions, but J. Bernoulli immediately guessed the author; "tanquam," says he, "ex *ungue Leonem*." This method of defiance, then in vogue, was again presented some years later to Newton, but by a more formidable adversary, and in a case where victory was of still more importance. In 1716, when the dispute about the invention of the infinitesimal analysis was at his height, Leibnitz wishing to show the superiority of his calculus over Newton's method of fluxions, sent, in a letter to the Abbé Conti, the enunciation of a certain problem, in which it was required to discover a curve such as should cut at right angles an infinity of curves of a given nature, but all expressible by the same equation; "he wished," he said, "to feel the pulse of the English analysts." Of course the question was a very difficult one. It is said that Newton received the problem at four in the afternoon as he was returning from the Mint, and, that though extremely fatigued with business, yet he finished the solution before retiring to rest. It has been, however, justly remarked, that Newton only gave the differential equation for the problem, and not its integral, in which the real difficulty consists. This was his last effort of the kind; and he soon entirely ceased to occupy himself with mathematics: so that during the last ten years of his life, when consulted

about any passage in his works, his reply was, "Address yourself to Mr. De Moivre, he knows that better than I do." And then, when his surrounding friends testified to him the just admiration his discoveries had universally excited, he said, "I know not what the world will think of my labours, but, to myself, it seems that I have been but as a child playing on the sea-shore; now finding some pebble rather more polished, and now some shell rather more agreeably variegated than another, while the immense *ocean of truth* extended itself *unexplored* before me."*

This profound conviction of the numerous discoveries that still remained to be made, did not, however, bring him again on that sea where he had advanced so much farther than any other man. His mind, fatigued by long and painful efforts, had need of complete and entire repose. At least we know, that thenceforward he only occupied his leisure with religious studies, or sought relief in literature or in business. Newton, the greatest of mankind in science, was, if we may dare to say so, but an ordinary man in other pursuits; he never distinguished himself in parliament, to which he was twice summoned; and in one instance he appears to have acted with inexplicable timidity.† In 1713, a bill was brought in for encouraging the discovery of a method for finding the longitude at sea. Whiston, the author of the bill, and who himself tried to gain the reward proposed in it, obtained the appointment of a committee for discussing the measure; and four members of the Royal Society were invited to attend—Newton, Halley, Cotes, and Dr. Clarke: the three latter gave their opinions verbally, but Newton read his from a paper he had brought with him, without being understood by any one; he then sat down and obstinately kept silence, though much pressed to explain himself more distinctly. At last Whiston, seeing the bill was going to fail, took on himself to say, that Mr. Newton did not wish to explain more through fear of compromising himself, but that he really approved of the measure. Newton then repeated word for word what Whiston had said, and the report was brought up. This almost puerile conduct, on such an occasion, tends to confirm the fact of the aberration of Newton's intellect in 1695, though it might have been merely the effect of excessive shyness, produced by the retired and meditative habits of his life. For, to judge from a letter of Newton,* written some time before the disastrous epoch, in which he points out the conduct to be pursued by a young traveller, it would appear that he was very ignorant of the habits of society.

From the manner in which his life was spent, we may easily conceive that he was never married, and (as Fontenelle says) that he never had leisure to think about it; that being immersed in profound and continual studies during the prime of his life, and afterwards engaged in an employment of great importance, and ever quite taken up with the company which his merit drew to him, he was not sensible of any vacancy in life, nor of the want of domestic society. His niece, who with her husband lived in his house, supplied the place of children, and attended to him with filial care. From the emoluments of his office—from a wise management of his patrimony—and from his simple manner of living, Newton became very rich, and employed his wealth in doing much good. He thought, says Fontenelle, that a legacy is no gift, and therefore left no will—it was always out of his *present* fortune that he proved his generosity to his relations, or to the friends whom he knew to be in want. His physiognomy might be called calm rather than expressive, and his manner languid rather than animated: his health remained good and uniform till his eightieth year; he never used spectacles. About that age he began to suffer from an incontinence of urine; but notwithstanding this infirmity, he still had, during his five remaining years, long intervals of health, or at least of freedom from pain, obtained by a strict regimen and other precautions, which till then he had never had occasion for. He was now obliged to rely upon Mr. Conduit, who had married his niece, for the discharge of his official duties at the Mint. Newton was useful to Conduit, even after death: for the honourable confidence that existed between them gave him a sort of claim to the office, which the king eagerly confirmed.

* This anecdote is mentioned in a manuscript of Conduit. Vid. Turner.

† This anecdote is mentioned by Whiston in his work, "Longitude Discovered,"—8vo. London, 1738.

* Biographia Britannica, p. 3242.

"Newton," says Fontenelle, "did not suffer much, except in the last twenty days of his life: it was truly judged from the symptoms, that he was afflicted with the stone, and that he could not recover. In the paroxysms of pain, he uttered not a moan, nor gave any sign of impatience; and, as soon as he had a moment of relief, he smiled and spoke with his usual gaiety. Hitherto he had always employed some hours every day in either reading or writing. On Saturday the 18th of March, he read the papers in the morning, and conversed for some time with Dr. Mead, the physician who attended him, having then the perfect use of all his senses and his understanding; but in the evening, he entirely lost them without again recovering, as if the faculties of his mind were not destined to linger by degrees, but at once to vanish. He died the Monday following (March 20th, 1727,) at the age of eighty-five. His corpse lay in state in the Jerusalem Chamber, and was thence conveyed to Westminster Abbey; the funeral ceremony was numerously attended; the pall was supported by six peers; and every honour was paid to his remains."

The family of Newton, justly sensible of the distinction derived from their connexion with so great a genius, erected at a considerable expense a monument to his memory, on which is inscribed an epitaph, ending as follows:—"*Sibi gratulentur mortales tale tantumque exstitisse humani generis decus.*"—"Let mortals congratulate themselves that so great an ornament of the human race has existed"—an eulogy which, though true in speaking of Newton, can be applied to no one else.

Besides the works we have already mentioned, Newton published an edition of the "Geographia Generalis" of Varenius, 8vo, 1672, reprinted in 1681. There is no really complete edition of the works of Newton, though Bishop Horsley published one in five volumes, 4to, to which he has given this title; but he has omitted a number of papers collected by Castillon (4 vols. 4to, Lausanne, 1744). By joining to these two books Newton's scientific letters inserted in the Biographia Britannica, we may make a tolerably complete collection of his works. Among the numerous translations that have appeared of the principal ones, we must not omit that of the Principia in French by Madame Duchâtelet, since it contains excellent notes supposed to be by Clairault. There are also two books in English, viz. H. Pemberton's "*View of Sir I. Newton's Philosophy*," (London, 1728, 4to), and C. Maclaurin's "*Account of Sir I. Newton's Philosophical Discoveries*," both of which will well repay the trouble of perusing them. It is, however, in the writings of the modern continental mathematicians, that we find the more complete developement of those brilliant discoveries which have shed so much lustre on the name of Newton. It is with the works of LAPLACE, Lagrange, Biôt, Lacroix, Monge, Garnier, Poisson, DELAMBRE, Boucharbat, Carnot, Bailly, Bernouilli, Euler, Bossut, Montucla, De Zach, Lalande, Francœur, Legendre, Poisson, Gauss, Hauy, &c. &c., that the student must become acquainted, before he can hope to attain to a thorough knowledge of the system of the universe. In science, it is perhaps more necessary than in any other species of knowledge intimately to understand what has been done by our predecessors; and it therefore becomes our duty to express our earnest hope, that our readers will not merely content themselves with studying the works of that great man whose discoveries we have in this treatise recorded, but that, endeavouring themselves to enter on the same illustrious career, they will diligently peruse the writings of the distinguished individuals whose names we have just mentioned. A list is given in *Hutton's* Mathematical Dictionary of the principal MSS. now in existence, that were written by Newton.

# LIST

## OF THE EDITIONS OF NEWTON'S WORKS.

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1779-85 Works by Bp. Horsley, 5 vols. 4to. London.
1744 Opuscula Mathematica, Philosophica et Philologica cura Castillionei, 3 vols. 4to. Lausanne et Geneva.

Various pieces are to be found in:

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| Commercium Epistolicum Collins.<br>Gregory's Catoptrics.<br>Birch's General Dictionary.<br>Philosophical Transactions.<br>Greave's Works. | all enumerated at length in Watt's Bibliotheca Britannica. |

### *Analysis per Quantitatum Series, Fluxiones, et Differentias, cum Enumeratione Linearum Tertii Ordinis.*

(printed originally with the Optics.)

1711 Analysis, etc. London. (*Cura Jones.*)
1736 Analysis. Method of Fluctions and Infinite Series, translated by Colson, 4to. London.
1737 Analysis. Method of Fluxions and Infinite Series. 8vo. London.
1776 Analysis. Method of Fluctions and Infinite Series, by Colson. 4to.
1740 Analysis. Mêthode des Fluxions, etc. par Buffon. 4to. Paris.

### *Newtoni Arithmetica Universalis, sive de Compositione et Resolutione Arithmetica.*

1707 Arithmetica Universalis. 8vo. Londini. (*Cura Whiston.*)
1722 Arithmetica Universalis. 8vo. London.
1732 Arithmetica Universalis. 4to. Lugd. Bat. 1732. (*Cura Gravesande.*)
1761 Arithmetica Universalis cum Comment. Castillionei, 2v. 4to. Amstel.
1728 Universal Arithmetick, by Ralphson and Cann. 8vo. London.
1769 Universal Arithmetick, by Ralphson, with notes by Wilder. 2 vols. 8vo. London.
1802 Arithmetique Universelle, par N. Beaudeux, avec des Notes. 2 vols. 4to. Paris.

1657 Astronomia Britannica. 4to. London.

### *Chronology.*

1726 Abregé de Chronologie. *See* Watt's Bibl. Brit.
1728 Chronology of Ancient Kingdoms amended. 4to. London.
1728 Chronologie, par l'Abbé Granet. 4to. London.
1745 Chronologie der Ælteren Königreiche. 8vo. Hildburghausen.

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| 1672 Varenii Geographia. 12mo. Cantabr.<br>1681 Varenii Geographia. 12mo. Cantabr.<br>1712 Varenii Geographia. 8vo. Cantabr. | edited by Sir I. Newton. |

1687 Philosophiæ Naturalis Principia Mathematica. 4to. Londini.
1713 Philosophiæ Naturalis Principia Mathematica. 4to. Cantabr. (Cotesii.)
1726 Philosophiæ Naturalis Principia Mathematica. 4to. Londini. (Pemberton.)
1730 Philosophiæ Naturalis Principia Mathematica. 2 vols. 8vo. Londini. (Donick.)
1723 Philosophiæ Naturalis Principia Mathematica. 4to. Amstelodami. (Cotesii.)
1765 Philosophiæ Naturalis Principia Mathematica—Excerpta, cum Notis. 4to. Cantabrigiæ.
1714 Philosophiæ Naturalis Principia Mathematica. 4to. Amstelod. (Cotesii.)
1739-42 Philosophiæ Naturalis Principia Mathematica, perpetuis Commentariis Illustrata, Communi Studio. Th. Le Seur et Fr. Jacquier. 4 vols. 4to. Genevæ, 1739, 40, 42.
1760 Philosophiæ Naturalis Principia Mathematica, perpetuis Commentariis Illustrata Communi Studio. Th. Le Seur et Fr. Jacquier, 3 vols. in 4. 4to. Colon. Allobrog.

1822 Philosophiæ Naturalis Principia Mathematica, perpetuis Commentariis Illustrata, Communi Studio. Th. Le Seur et Fr. Jacquier, Editio Stereotypa. 4 vols. roy. 8vo. Glasguæ.
1729 Mathematical Principles of Natural Philosophy, translated into English by Motte, with the Laws of the Moon's Motion, according to Gravity, by J. Machin. 2 vols. 8vo. London.
1819 ——— The same. 3 vols. 8vo. London.
1777 Mathematical Principles of Natural Philosophy, by Thorpe. 4to. London.
1802 Mathematical Principles of Natural Philosophy, translated and illustrated with a Commentary, by Dr. Thorpe. 4to. London.
1738 Elémens de la Philosophie, par Voltaire. 8vo. Amsterdam.
1759 Principes Mathématiques de la Philosophie Naturelle par Mad. du Châtelet. 2 vols. 4to. Paris.
1752 Elémens de la Philosophie, par Voltaire. 8vo. Dresden.
1781 Philosophiæ Naturalis Principia Mathematica. 4to. Dessoviæ. (TESSANECK).

1699 Barrow's Optical Lectures, edited by Sir I. Newton. 4to. Londini.
1704 Optics; or a Treatise of the Reflections, Refractions, Inflections and Colours of Light. Also two Treatises of the Species and Magnitude of Curvilinear Figures. 4to. London.
1730 Treatise of Optics. 8vo. London.
1721 Treatise of Optics. 8vo. London.
1714 Treatise of Optics. 8vo. London.

1745 Two Treatises of the Quadrature of Curves, by Stewart. 4to. (*vid.* Watts.)

1706 Optica, Latinè reddita a Sam. Clark, necnon ejusdem Tractatus duo de Speciebus, etc. Fig. Curvilin. 4to. Londini.
1719 ——— Idem. 4to. Londini.
1721 ——— Idem. 8vo. Londini.
1728 ——— Idem. 8vo. Londini.
1740 ——— Idem. 4to. Lausanne.
1773 ——— Idem, accedunt ejusdem Lectiones Opticæ, et Opuscula ad Lucem et Colores Pertinentia. 4to. Patavii.
1729 Lectiones Opticae. 4to.
1728 Optical Lectures read in the Public Schoos: 8vo. Cambridge.

1762 De Quadratura Curvarum, ed. Mclander. 4to. Lipsiæ.
1740 Genesis Curvarum per Umbras, seu Perspectivæ Universalis Elementa Exemplis Coni Sectionum et Linearum Tertii Ordinis illustrata, 4to. L. Bat.
1746 Genesis Curvarum, etc. 8vo. London, (ed. Murdoch.)

1797 Enumeratio Linearum Tertii Ordinis, edidit Stirling. 8vo. Paris.

## *Newton's System of the World in a Popular Way.*

1727 System of the World in a Popular Way. 8vo. London.
1728 De Mundi Systemate. 4to. Londini.
1731 De Mundi Systemate. 4to. Londini.
1747 Weltwissenschaft für Ungebildete. 8vo. Brunswick.

1733 Construction d'un Télescope Reflexion. 4to. Paris.
1731 Tables for Renewing and Purchasing Leases. 12mo. London.
1808 Tables for Renewing and Purchasing Leases. 12mo. London.
1741 Metaphysik (in German) 8vo. Leipzig.
1717 Postscript and Letter of Mons. Leibnitz to the Abbé Conti, with remarks and a letter to the Abbé
1756 Four Letters to Bentley on the Existence of a Deity. 8vo.
1733 Observations on Daniel and Revelations. 4to. London.
1765 Beobachtungen uber Daniel und die Offenbarung Joannis. 8vo. Liegnitz.
1737 Observationes in Danielem et Apocalypsin Joannis, Latine vertit Sudemann. 4to. Amstelodami.
Corollarics by Whiston.

(8)

GORTON, John G.

# ADMIRAL BLAKE.

## CHAPTER I.

*Birth and Parentage — Academical Education and Pursuits—Acquires great Influence with the Puritan Party—Chosen Member for Bridgewater—Embraces the Cause of the Parliament against Charles I.—Services at Bristol, Lyme, and Taunton.*

FEW men occupy an important place in the military and naval annals of England, who have more conspicuously exhibited the intellectual and moral qualities which favourably distinguish the character of British seamen than Admiral Blake. Much of the war-like distinction, to attain which this country has made such sacrifices, is attributable to a combination in its inhabitants of active with passive courage; or of daring valour and an ardent spirit of enterprise, with firmness, perseverance, and intrepid endurance. When, to these qualifications can be added, patriotism, disinterestedness, and a correct notion of the due boundaries of obedience and command, little more is wanted to complete the outline of an accomplished English officer. All these requisites were displayed, in an eminent degree, by the individual, a brief sketch of whose life will be attempted in the following pages, who has always ranked high in the estimation of his countrymen, notwithstanding the party bias, so powerfully excited by the political occurrences of the period in which his lot was cast.

Robert Blake was born in August, 1599, at Bridgewater, in the county of Somerset. His father, Humphrey Blake, a respectable merchant of that town, was a branch of the Blakes of Plansfield, in the parish of Spaxton,* in its vicinity; a family which bore the rank of respectable country gentlemen. Having amassed a good fortune by the Spanish trade, he bought an estate in the neighbourhood of Bridgewater, where he settled, and had a numerous family. At a proper age, Robert, who was the eldest, attended the Free Grammar School of his native place; whence, at the death of his father, being then of the age of sixteen, he removed himself to Alban's Hall, in the university of Oxford. Here he was noticed for early rising and studious application; which he diversified by the sports of fowling and fishing. As he became too noted a public character, in the sequel, for any sort of traditionary scandal concerning him to escape publicity, it has been asserted that he occasionally amused himself with stealing swans;* doubtless in the estimation of those times, nothing more than a species of aquatic poaching. From Alban's Hall, he, after a while, removed himself to Wadham College, where he took the degree of Bachelor of Arts; and in 1619, being then about twenty-one years of age, he became candidate for a Fellowship of Merton College. In this object of his ambition he however failed, owing to the opposition of Sir Henry Savile, then Warden, on the extraordinary ground of not being tall enough. Although it was one of the known foibles of that eminent scholar, to pay a great regard to personal comeliness, there is reason to believe that the religious opinions of the candidate formed the principal cause of his rejection; his family and connexions being, for the most part, inclined to Presbyterianism, or at least opposed to the domineering scheme of church government, which the court and prelacy were then endeavouring to carry into practice. However this might be, his non-attainment of a fellowship probably altered the entire course of his future destiny; for so long a residence at the university, and his wish to obtain that kind of preferment, seem to indicate literary, if not professional views, altogether at variance with his future career. If so, Blake is only one among a multitude of distinguished characters, whom the course of events, rather than premeditation or design, has conducted into that line of exertion, for which their natural endowments have more especially adapted them.

* Lives, English and Foreign, vol. ii. p. 73. Wood's Fasti. Oxon. vol. i. col. 203.

* Wood's Fasti, vol. i. col. 203.

Mr. Blake remained at the university until his twenty-fifth year, during which period, according to Lord Clarendon, he obtained as great a portion of learning, as any gentleman of independent prospects, not expressly intended for a learned profession, needs acquire.* This testimony is sufficient to discountenance an insinuation, that he lost the sought for fellowship by want of sufficient erudition; but it at the same time proves that he was never a distinguished student. All that is known of his literary performances, is a copy of verses on the death of the celebrated antiquary Camden, one of those fruits of imitation rather than of native impulse, or genius, which may sometimes be admired as college exercises, but seldom as any thing more. Such, unfortunately, owing to the very mature age to which he arrived before he became distinguished, is all that it has been found possible to collect concerning the early life of Admiral Blake. This is too common a circumstance in biography, to be the subject of particular regret; but it is still to be lamented, as a study of well authenticated accounts of the youthful predispositions of eminent men, is both profitable and amusing. In the great variety and complexity of human character, it may not be always safe to depend upon like results from similar appearances; but in social and intellectual, as well as in physical knowledge, cool and patient observation will gradually account for much apparent diversity. The utility too, as regards education, is undeniable; an early discernment of the indications of future modes of thinking and acting, and a close attention to the formation of habits, being among the most useful qualifications with which all who have to do with the bringing up of youth, whether as parents or teachers, can be endowed.

On quitting the university, Mr. Blake took up his residence at Bridgewater, where he soon became distinguished for soundness of understanding, gravity of deportment, and plain sincerity of temper; all bespeaking the strength and solidity of character which he afterwards displayed. It is, at the same time, recorded that a humorous bluntness of expression rendered him a very entertaining and agreeable companion, notwithstanding the apparent austerity of his manners;† and that, taken altogether, he was admirably adapted to acquire influence with the powerful and rising party to which he was attached both by principle and connexion. It has already been observed, that this party was the Nonconformists, or Puritans, which, from the nature of the times, and the infatuated conduct of the reigning family and its advisers, soon became strongly, although far from universally, tinctured with republicanism. To whatever extent it may be conceded that it was natural for the House of Stuart to claim the same extent of prerogative as its predecessors, it must be allowed by all, except the most prejudiced of its partisans, that the arbitrary system which it adopted, was carried most unwisely into practice. Disgusted, in common with a great portion of the nation, at the measures of the court, and still more annoyed by the severe and intolerant proceedings of Laud, then Bishop of Bath and Wells, the diocese in which he lived, Mr. Blake was the more confirmed in the religious and political opinions, which equally agreed with his own natural seriousness, and the prevalent bias of the inhabitants of his native place. Expressing his sentiments freely, and without concealment, he gradually acquired that influence with his party, which his talents and general respectability were so well calculated to command; so that in 1640 he was chosen Member of Parliament for Bridgewater. This parliament was, however, so soon dissolved, that he had no opportunity of distinguishing himself as a politician; and for the next, which was the memorable Long Parliament, he lost his election.

When in 1642, the differences between the King and the Parliament broke out into actual hostilities, Blake, in common with many of the most active and energetic men of the period, immediately embraced the party of the latter, and raised a troop of dragoons, which he personally commanded as captain. He was at this time in his forty-second year, having attained the meridian of life, before he commenced those warlike pursuits in which he so rapidly acquired a distinguished name. This circumstance, while remarkable in itself, tends in some degree to detract from the interest of this narrative as a piece of biography. It is natural to wish for some satisfactory particulars of the first forty years of the life of a man whose conduct has made the remainder of it celebrated;

* History of the Rebellion, vol. iii. p. 601. Bates.
† Bates's Elenchus Motuum, p. 228.

but unhappily, except a few scattered notices by Lord Clarendon, Anthony Wood, and Dr. Bates, very little is recorded concerning Blake before he was called into activity by the civil war. The rapidity with which he then acquired eminence as a warrior, both by sea and land, will give a very different complexion to what will follow, his own history, from the period in question, being identified with that of his country. He forms, indeed, one of the most conspicuous examples which modern times have produced, of a man stepping from private life into command, and becoming almost at once a distinguished leader. In the republics of Greece and Rome it was more common, although probably when duly considered less extraordinary, as the institutions of both the Greeks and Romans, in many respects, made every man a soldier. Such was not the case in England during the age of Blake; although the facility with which many of the energetic spirits of the day passed from civil life into active military command, seems to indicate that the temper and construction of British society were not unfavourable to the transition. Or rather, ought we not, as in a more recent period of revolutionary history, to attribute the almost spontaneous appearance of the ability, to the strength of the excitement: and is it not upon the whole consolatory to reflect, that when the souls of men are moved, and their actions dictated by principles, their energies are better seconded by their understandings?

But to return to the narrative: the first opportunity Mr. Blake acquired of distinguishing himself was in 1643, when he served at Bristol under Colonel Fiennes, who intrusted him with the defence of a small fort on the lines. When the governor agreed to surrender that important city to Prince Rupert, on the 26th July, Blake refused to give up his post, and continued to fire upon the Royalists. At this the prince was highly exasperated, and declared, that when he took the place he would hang him. Some friends, however, interfered, and pleaded his inexperience in the usages of war; and, at the same time, urged Blake to refrain from an entirely useless resistance, to which advice, although with great difficulty, he was finally induced to accede.* The conduct of Blake in this respect, so indicative of the spirit and tenacity of the man, has been considered to be, on military principles, irregular; but it should be remembered, that one of the charges against Colonel Fiennes, on his trial before a council of war at St. Alban's, for his conduct at the siege of Bristol, was, that he left Captain Blake in the fort, when he marched out of that city, without giving him any notice of the surrender, or any warrant to deliver up his charge, to the great danger of the lives of Captain Blake and his men.*

Blake subsequently served in Somersetshire as Lieutenant-Colonel of the regiment of foot of Colonel Popham, then in garrison at Lyme, of which town the latter officer was parliamentary governor. Here he acted with so much activity and ability, when the place was besieged by Prince Maurice and Lord Goring, that Popham left its defence entirely to his management; and he so effectually exerted himself, that the Royalists, after being baffled in repeated attempts at storming, and losing a great number of men by the vigorous sallies of the besieged, gave up the attempt and departed.†

His next service was of great importance: Popham's regiment having been raised in Somersetshire, throughout which county Blake was exceedingly popular, he was known and much beloved by all the soldiers who served under him. This attachment was not only highly serviceable to him in the field, but procured him the best intelligence of the state of things around, through the medium of the friends and connexions of his men, all over the county. By these means he acquired intelligence which enabled him, in conjunction with Sir Robert Pye, to surprise Taunton, where they found six cannon and a considerable quantity of ammunition. In 1644, the Parliament appointed him governor of this town, one of the most important in the west of England, being then the only garrison in the parliamentary interest in that part of the country.‡ The works erected in defence of Taunton were far from strong, and the garrison by no means numerous; yet by maintaining a strict discipline, and by treating the inhabitants with consideration and humanity, he managed, with very little assistance from supplies, to retain the place, although repeatedly besieged and blocked up by the King's

* Hist. of the Rebellion, vol. iii. p. 602.

* Howell's State Trials, 224, 252.

† Lives English and Foreign, vol. iii.

‡ Rushworth's Hist. Collections, vol. v. p. 685.

forces. He had not, indeed, been long there before the Earl of Essex, commanding for the Parliament, was obliged to capitulate in Cornwall, and to surrender his army to the King, an event which was followed by an unresisted scouring of the western counties by the Royalists. Of these troops 3000 ventured to approach Taunton; on which Blake sent out a party from the town, who defeated them with great slaughter, and took several officers of note prisoners. He also cleared all the roads around his post from the armed interruption of a number of cavalier country gentlemen of the vicinity, who frequently behaved with great ferocity to those passengers that were supposed to be adverse to the royal cause.*

Annoyed by this activity, Lord Goring came into the neighbourhood of Taunton with a body of Royalists, amounting to 10,000 men; and pressed the works so closely, that he made a breach in the line of defence, and took actual possession of a part of the town. Blake however, still contrived to retain the castle and the remainder of the town, although in the greatest distress both for ammunition and provisions. Aware of this fact, the besiegers summoned him to surrender, the message being conveyed to him by Colonel Windham, governor of Bridgewater, for the King, who happened to be at that time with the royal army. The first summons demanded instant surrender, on pain of fire and sword; which being treated with disregard, Windham, who had been on intimate terms with Blake, mildly endeavoured to persuade him to spare an unnecessary effusion of Christian blood. To these repeated demands Blake at length made the following characteristic reply:—

"These are to let you know, that as we neither fear your menaces nor accept your proffers, so we wish you for the time to come to desist from all overtures of the like nature to us, who are resolved, to the last drop of our blood, to maintain the quarrel we have undertaken; and doubt not that the same God who has hitherto protected us, will ere long bless us with an issue answerable to the justice of our cause. However, to him alone, we shall stand or fall."†

Soon after the despatch of this letter, a body of parliamentary troops broke through the besieging force, and supplied the town with provisions and other necessaries. The main army of the Parliament could not however move so rapidly to the relief of Taunton as the situation of the governor and garrison required, owing to the time necessary for the re-officering it under the famous self-denying ordinance.* Before, therefore, effective succour arrived, the besiegers had destroyed the suburbs and half the town, and Blake could with difficulty maintain even the castle. At length Major General Skippon was directed to join Sir Thomas Fairfax, and march to the aid of Blake with 8,000 men, and a train of artillery, and money and provisions were sent after them.

In the mean time, fully acquainted with the great distress of the garrison, the besiegers sent another summons to Blake to surrender, to which he briefly replied, that he would eat his boots first. He then calmly proceeded to barricade the part of the town which he still retained with all sorts of lumber; and made the Royalists pay dearly for every step of ground that they acquired. At last, Lord Goring and Prince Rupert were called away, with part of the besieging force, to the king's relief at Oxford; but the approaching army of Sir Thomas Fairfax and General Skippon being diverted to the same scene of hostilities, a strong detachment only, under the command of the Colonels Weldon and Greaves, could be spared for the relief of Taunton. This force, however, proved sufficient for the service; and on the 11th of May 1645, the Royalists were obliged to raise the siege, after they had lost 1000 men, and sent away twelve waggon loads of wounded. For this spirited defence, the parliament voted a letter of thanks to Colonel Blake, with a donation of 500*l.*, and 2000*l.* to be distributed among the garrison. A general collection was also made to restore the houses destroyed during the siege.

The possession of Taunton by the Parliamentarians, proved so injurious to the royal cause, that another attempt was soon after made to take it, by the united forces of Lord Goring, Sir Richard

* Sir Francis Doddington meeting a divine, exclaimed, "Who art thou for, priest?" "For God and his gospel," he replied; which answer being deemed a declaration for the Parliament, Sir Francis shot him dead upon the spot.—*Lives English and Foreign.*

† Lives English and Foreign, vol. ii. p. 81, 82.

* An act passed through the intrigues of Cromwell and the Independents, by which all members of Parliament were to abstain from military command, except Cromwell himself, a scheme to get the army into the hands of his own partizans, and to exclude the Presbyterian and other leaders of reputation from acquiring influence with the soldiery.

Greenvillé, and Colonel Berkely. They suffered much from the spirited sallies of the besieged, under the command of Colonel Weldon; and when the latter, on one occasion, was nearly surrounded by the enemy, Blake marched out to his relief at the head of two troops of horse, and charged the cavaliers so fiercely, that Weldon was enabled to gain the town, into which Blake and his party followed in good order. On learning the renewed attempt upon Taunton, the city of London voluntarily granted 4000*l.* to raise and equip 1000 horse, to be sent to the assistance of the governor, under the command of Major-General Massey; and the committee of Kent supplied two troops of dragoons, and two companies of infantry, for the same service. The distress of the garrison, during these preparations, was very great; but although Blake could acquire no precise information when succour might be expected, he resolutely held out, and continued to annoy the enemy with great effect, until the junction of the parliamentary forces, under General Massey and Sir Thomas Fairfax, once more obliged Lord Goring to raise the siege.*

It has been necessary to dwell at some length on this obstinate defence of Taunton, for two reasons: in the first place, to show the rapid developement of Blake's talents as a commander; and in the second, because this protracted occupation of a large portion of the king's troops, materially tended to hasten the final defeat of the royal cause. It was the known distress of Blake in Taunton, and a supposition that, if pressed, he must surrender in a few days, that induced the king to divide his forces, and thereby hasten the decisive battle of Naseby, which Fairfax would not have risked, had the royal army remained entire. At the same time, the large body of troops despatched on this service, not only completely failed to accomplish its object, but, in the sequel, was routed and dispersed altogether. It seldom happens that a single, and apparently a mere subordinate military exertion, leads to consequences so important.†

After refreshing and recruiting his garrison, Blake marched with a party of his men, and captured Dunster Castle, held by the Luttrell family for the crown. This event, which was one of the last transactions of the war, took place in April 1646, when he returned in triumph to Taunton, and to the enjoyment of a considerable interval of repose.

It has already been seen how promptly Colonel Blake espoused the side of the parliament, in a contest rendered equally inevitable by the progress of opinion among the people, and by the too natural blindness of authority to the necessity of yielding, more or less, to a decided change in national sentiment. Without entering into the question of the practice of their predecessors, the religion and government of James I. and Charles I., no matter whether adopted or inherited, were essentially intolerant and arbitrary. What is equally undeniable, principles in respect to both were ostentatiously promulgated, at a period not only when the common sense of mankind began very generally to revolt at them, but when the rising power of the popular branch of the constitution, and the diversity of religious opinion, rendered their establishment as impracticable as unpalatable. This weakness necessarily threw all the strong and sturdy spirits, most opposed to indefinite prerogative and ecclesiastical intolerance, into the opposite extreme of republicanism. But it was not monarchy and episcopacy simply, as such, that the more disinterested and well principled of these opposed in the first instance; but monarchy and episcopacy as defined by the court and high church party.* The mischievous doctrines of passive obedience and divine right, which will always prove snares and pitfalls to sovereigns, who are misguided enough to govern as if they believed in them, were every day maintained, not merely as favourable, but essential to the English constitution. The history of the country, since that period, has happily proved, that a crown requires the diffusion of no such principles for its due support. Grant, indeed, as was then demanded, a dispensing power or privilege of suspending the authority of the law, the right to raise taxes without the consent of parliament, and the liberty to prosecute for difference of religious opinions, and claim, at the same time, passive obedience from the people, and what but arbitrary government can ensue? The obsti-

* Lives English and Foreign, vol. ii. p. 85.

† Rushworth's Hist. Coll. vol. vi. p. 28.

* The struggle no doubt rapidly became one for ascendancy on both sides; the too frequent consequence of appeals to arms to settle civil and religious differences. That which might be *equality* if bestowed, usually becomes *ascendancy*, when fought for.

nate claims of this description, on the part of Charles I. and his advisers, should always be borne in mind, in judging of the conduct and motives of men so undeniably disinterested and honourable as Blake; for it was not surprising that individuals of that class, who conscientiously maintained the religious tenets so undisguisedly assailed, should pass over limited monarchy, in their theoretical march to political liberty. It may be said that these observations will only apply to the first part of the reign of Charles I.: it may be so, to a certain degree; but the conduct of the family, when restored, too powerfully justified the distrust always entertained of it by those who were convinced that it would never willingly govern under the restraint of a well-regulated constitutional system, or sincerely give up the dangerous pretensions which its final expulsion alone terminated.

It was doubtless under the impulse of convictions, more or less akin to those alluded to, that Blake chose his party on the commencement of the disastrous conflict; and it is therefore highly to his credit and consistency, that he took no share in any of the measures which gradually changed the complexion of a contest for civil and religious liberty, into a struggle for personal interest and ambitious aggrandisement. Thus, for some time after the relief of Taunton, he took little part in public business, disliking the proceedings of the Independents and the army; and the expulsion of the Presbyterians. Nor, though inclined to a commonwealth, did he approve of the trial of Charles I., the execution of whom he deemed barbarous and illegal. He even went so far as to assert "that he would as freely venture his life to save the king, as he had done to serve the Parliament.* But, however much opposed to the arbitrary and vindictive measures against the life of the king, Blake seems entirely to have given up all hopes of agreement with Charles, after his refusal to accept the terms proposed to him while with the Scottish army. He had therefore joined the borough of Taunton in a petition to the House of Commons, never again to address the king; but he was invariably averse to any stronger measure than his deposition. His disapprobation of harsher proceedings indeed, was so well understood by Cromwell, that, when the trial of the king was determined upon, a part of the forces, under Blake, was disbanded; and, to conceal the motive, the order was accompanied with a parliamentary compliment, and a donation of 500*l.* This aversion to every thing sanguinary, out of the field, was conspicuous in the whole of his conduct; and it forms the brightest part of his brilliant character that in all parleys and negotiations with the royalists, and especially in the treatment of the vanquished, he was invariably feeling and considerate. This humane disposition, added to the fact, that the whole of his career was rather that of an open and honourable warrior, than of an interested politician, has rendered him comparatively a favourite, even with the royalists. No man on the parliamentary side has been treated so tenderly by the numerous vindicators of Charles I., as Blake; owing partly, no doubt, to so many of his subsequent exploits, redounding to the honour of the country; but also, in no mean degree, to the frank and sincere character of the man.

But although personally averse to the trial and condemnation of the king, having strongly imbibed republican sentiments, Blake had no objection to the abolition of kingly government, and therefore after the unfortunate monarch's execution, he quickly fell in with the views of the prevailing party; and next to Cromwell, and possibly Ireton, was considered to be one of the most able and efficient officers of the commonwealth. Unlike the former leader, although doubtless anxious for glory, his services were no other way connected with views of self aggrandisement; and he seems to have aspired rather to be useful to his country, within the sphere of his acknowledged abilities, than to sway either as a legislator or politician. It has been alleged, and most probably with justice, that he formally adopted the principle, common to several of the most virtuous public characters of Greece and Rome, that it was a duty to serve his country under all circumstances; and he seems to have satisfied himself in the various changes of the times, by adhering to what he deemed its true interests. It is one of the unavoidable results of this line of conduct, that it renders honourable men occasionally subservient to the more interested views and purposes of others; and in this manner, the exertions of Blake were made conducive to the

* Lives, English and Foreign, vol. ii. p. 85.

advancement of Cromwell. He was not, however, such a man as that wily politician wished to have in his councils, and it is therefore conjectured, that his destination, which was from this time exclusively to the sea service, originated in Cromwell's anxiety to employ him where his talents would at once be efficient for the country, and powerless for the acquirement of any influence that might be directed against himself. Whether this supposition be justly founded or not, the well-judged appropriation of Blake to the navy, led to consequences of no small moment in the naval history of Great Britain.

## Chapter II.

*Union of Military and Naval Command —Blake, Deane, and Popham appointed Commissioners of the Navy —Blake ordered to pursue the Fleet under Prince Rupert—Transactions in the Tagus—War with Portugal—Proceedings at Carthagena and Malaga—Defeat of Prince Rupert — Reprisals on France — Blake's Treatment of a French Captain—Services against the Isles of Scilly and Guernsey—Causes of War with the Dutch—First Engagement with Van Tromp—Expedition to the North.*

For nearly a century and a half, the naval service of Great Britain has been rendered so strictly nautical, that the appointment of a soldier, nearly fifty years of age, to the command of a fleet, will be deemed extraordinary by those who are unacquainted with the progress of our maritime power towards its present superiority. In the reign of Elizabeth, such were the circumstances of the period, that men of great maritime experience were necessarily called into naval service; as for instance, Hawkins, Drake, Frobisher, and others; none of whom had been originally officers of the navy in the present sense of the term. In the same manner, the conduct of the fleet was often given to any nobleman, or officer possessed of general abilities for command; and this continued to be the case until towards the close of the reign of Charles II. During the Commonwealth, indeed, nearly all the most distinguished naval commanders had previously served in the army; although from the comparative perfection to which naval tactics have since been brought, and from the seamanship required in the manœuvres, on which they entirely depend, the conduct of a sea engagement, by a landsman, would, naturally enough, at this time be condemned as a very hazardous experiment. There was nothing, therefore, remarkable in the appointment of an officer of the talents and energy of Blake to the sea service: the genuine ground of surprise is, that he at once became the most able and successful naval commander of his day; but, promptness, decision, intrepidity, and enterprise, must at all times, form the chief ingredients of naval as well as of military heroism.

On the 12th February, 1649, the Colonels Blake, Deane, and Popham were appointed commissioners of the navy, and Blake himself was nominated to the command of a squadron, and ordered to sail in pursuit of the Princes Rupert and Maurice, who were in the Irish sea with that part of the fleet which had adhered to the king, and which was endeavouring to assist the Marquis of Ormond, then in arms for Charles II. in Ireland. Blake arrived with his fleet off Kinsale, in the following June, where the two princes lay in harbour. At the same time, Deane cruised off Plymouth, Popham between the Downs and Portsmouth, and Sir George Ayscue in the Bay of Dublin; by which several squadrons, the Parliament became completely masters of the sea. Such was the popularity of Blake, whom henceforward we shall call Admiral,* that the crews of the ships of Prince Rupert deserted to him daily, which induced the prince to execute ten seamen whom he detected in the attempt. Blake kept the royal ships blockaded until the following October, when despairing of relief by sea, and Cromwell being about to capture the town by land, Rupert and Maurice resolved to force their way through the blockading squadron, which, with the loss of three ships, sunk by Blake, they effected, and steered for Lisbon. Here they were kindly received, and sheltered by the King of Portugal; a duty of hospitality scarcely to be evaded by a monarch who had been in strict alliance with Charles I.

Blake rapidly followed the two princes

* He is indifferently called General or Admiral, in the original authorities: it has been thought better in the subsequent narrative, to adhere to the official designation which, in modern estimation, will be deemed most appropriate.

to the mouth of the Tagus, and by order of the Parliament demanded the ships of Prince Rupert, as belonging to the Commonwealth of England. This requisition extremely embarrassed the Portuguese Cabinet; as policy exacted a compliance, while honour and hospitality dictated a refusal. The latter in this instance prevailed; and as the Portuguese had reason, from the spirit and promptitude of Parliament, to anticipate immediate war, a squadron of thirteen Portuguese ships was rapidly equipped by them to join that of Prince Rupert and to attack the English, anywhere between the two capes of Finisterre and St. Vincent, that it might appear the King of Portugal sought only to secure his own coasts.

Aware of the above junction, Blake and his squadron sailed away; soon after which he was joined by another under Popham, when (in October, 1650) they fell in with a Portuguese fleet of twenty-three sail, richly laden and bound from Brazil for Lisbon. Of these they captured twelve, containing 10,000 casks of sugar, and burnt three; when finding themselves in want of stores, they sailed for England with their prizes. The coast being thus clear, Prince Rupert, after having involved the King of Portugal in an embarrassing war with the Commonwealth, quitted the Tagus, and proceeded to Carthagena. He was quickly followed by Blake, who in his way homewards having fallen in with five transports on their passage to him with provisions and stores, immediately returned to the pursuit of the royal squadron. On his arrival at Carthagena, he came to an anchor before the fort, and announced that he was sent by the Commonwealth to pursue the enemy who had taken shelter there; and, the King of Spain being in amity with England, he requested either that the fleet might be given up to him, or that he might be permitted to attack it. A refusal, on similar grounds to those alleged by the King of Portugal, was given; but on being further pressed, a promise was made by the Commandant to send for orders to Madrid. Blake, not thinking the prince would venture out, proceeded on a cruise, on which Rupert, with the ships under him, left Carthagena, and went into Malaga, where he was so ill advised as to sink and capture some English merchantmen. Informed of this transaction, Blake sailed immediately for Malaga, where he arrived in January 1651, and regarding the manner in which the prince had been allowed to act as dispensing with all ceremony, he attacked the royal squadron without reference to the Spanish authorities, and burnt or destroyed all but four or five ships, with which the two princes escaped to the West Indies, and supported themselves by capturing English and Spanish merchantmen. At length, Prince Maurice was cast away, and Rupert contrived with two or three ships to return to France, where he sold them with his prizes, on behalf of Charles II., to the French government. Such was the fate of a fleet of twenty-five finely-equipped ships, which on the execution of Charles I. had declared in favour of his son.*

A sort of equivocal warfare existed at this time, between the Commonwealth and France, brought on by the secret encouragement of French privateering, which proved very injurious to English commerce. Reprisals having been ordered, Blake had captured a French man-of-war of great value, previously to his first engagement with Prince Rupert. Soon after that victory, he fell in with another of forty guns, the commander of which, not apprized of the war between the two countries, was invited to visit the ship of Admiral Blake. He accepted the invitation without suspicion, and when he came on board he was informed of the war by the Admiral, who asked him if he would willingly resign his sword. The Frenchman spiritedly answered, No! on which, detesting all appearance of treachery, Blake told him to return to his ship, and fight it as long as he could, which he bravely did for two hours, and then surrendered.† This species of gallantry is attended with too great a carelessness of human life, to entitle it to the full acquiescence of reason and humanity; but it is highly characteristic of a frank and fearless nature, disdaining all advantages not obtained in an open and honourable manner. Not long after this exploit, the Admiral sailed for Plymouth, and on his arrival received the thanks of Parliament, and was appointed Warden of the Cinque Ports. His return to England took place in February, 1651; and in the following month an Act

* Life of Prince Rupert. Heath's Chronicle of Civil Wars, p. 275. Wood's Fasti. Oxon. vol. ii. col. 204.

† Life of Blake, in Gent. Mag., by Dr. Johnson.

passed to make Blake, Deane, and Popham, or any two of them, Admirals and Generals of the Fleet, for the year ensuing.

The next service intrusted to this able commander was the reduction of the Isles of Scilly, which still held out for the king. These islands not only afforded shelter for privateers, but it had been discovered that the Dutch were forming views upon them, and had despatched Admiral Van Tromp and a squadron of twelve ships of war, with instructions either to purchase or reduce them. On the arrival of Blake, with a body of eight hundred troops on board, Sir John Greenville, who commanded for the king, after some little resistance submitted upon terms; and retired to Guernsey, which had also been preserved for Charles II. by Sir George Carteret, aided by a garrison of four thousand men. The reduction of this island was forthwith undertaken by Blake, assisted by a strong body of troops commanded by Colonel Haynes. They reached Guernsey in October, 1651, but the defence was so spirited, that in spite of the most active exertions both by the squadron and troops, the various forts could not be mastered until the following January, when the Governor capitulated, and was treated by the Admiral with all the respect due to his bravery and honourable character.* For these services, the two Commanders were thanked by the House of Commons. It was during this stay of Blake before Guernsey, that he was appointed one of the Council of State for the ensuing year. The schemes of Cromwell were now reaching maturity, and he felt all the value of the support of such an able officer and national favourite.

The following year, Blake was constituted sole Admiral for nine months, in the prospect of a Dutch war; and here a period of the naval history of England and Holland commences, which, while it strongly exhibits the spirit and energy of the people of both countries, affords a melancholy proof of the barren and futile nature of much of the warfare which has distracted the world. The enmity between the English and Dutch at this period, originated principally in commercial and maritime rivalry, directed in each state to party and personal purposes. It is difficult now to ascertain which of the governments was the first aggressor; but there is no doubt that both were grievously to blame and that the hostilities which followed exhausted and weakened both sides, without proving in any essential respect serviceable to either. Hitherto indeed national emulation has been but another name for national enmity; but are there not some signs to show that a gradual improvement is taking place? And though it would be too sanguine to expect that powerful states will soon cease to be dangerous to their weaker neighbours, is it too much to anticipate, that with the increasing diffusion of knowledge, the gratification of mere personal ambition will be restrained; and that all those fancied necessities for war, which originate in mistaken views of political expediency, will yield to more enlightened principles, and more humane feelings? Highly indebted as were the United Provinces to the policy of Queen Elizabeth, for their emancipation from the intolerable yoke of Spain, the perpetually recurring stimulus of mercantile rivalry gradually overcame the recollection of those eminent services; especially as it was easy to interpret them into a political interference, which, considering the designs of Spain against England, it was as expedient for the latter to grant, as for the United Provinces to accept. Whatever the reason, their rapid growth into a maritime and commercial power was accompanied by envy of all correspondent advancement, on the part of a nation so admirably situated for the acquirement of that kind of superiority as Great Britain. This was exhibited in various ways during the reign of James I., whose anxiety for a close alliance with their formidable enemy, Spain, had still further excited their jealousy. Charles I. also obliged them to pay for a license for the right of herring fishing on the British coast, which claim, however reasonable, they resented, and resisted to the utmost of their power. The subsequent marriage of the Princess Mary, eldest daughter of Charles, with the Prince of Orange, likewise formed a strong party against the English Commonwealth, and (after the execution of that prince) in favour of Charles II.; a circumstance of itself quite sufficient to produce a disposition to war on the part of the English rulers.

Thus, on the death of Charles I. in 1649, satisfied that no molestation

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* Hist. of Rebellion, vol. iii. p, 265.

would ensue from France or Spain, the attention of the Independent leaders was drawn strongly towards the United Provinces, the strength of whose navy might render their espousal of the cause of the exiled king a source of considerable annoyance. Under these impressions, therefore, they sent Dr. Dorislaus, a civilian of Leyden, who had been naturalized in England, to the Hague, in order to produce a good understanding between the two republics; but unfortunately, he was assassinated by some Scottish royalists in that town the very evening of his arrival.* A suspected connivance at the escape of the murderers, produced a considerable sensation in England; but as the Parliament wished to form an alliance with the United Provinces, and as the death of the Prince of Orange afforded a favourable opportunity, the assassination of Dorislaus produced no interruption of these overtures, and in March, 1651, Oliver St. John, and Walter Strickland, were sent to the Hague, in the place of Dorislaus, to complete a treaty of union. This negotiation altogether failed, owing, as the Dutch writers affirm, to the unreasonable conditions insisted upon by the English; but more probably in consequence of an opinion that the affairs of Charles II. were not entirely hopeless, he being about to head his final expedition into Scotland, whither, indeed, the states themselves conveyed him. The Orange party was also strongly against any alliance which might defeat the future ascendancy of the infant prince; and thus the English envoys returned, not only disappointed, but incensed at the insults they had received from the common people at the Hague. No notice of this was however taken, until after the battle of Worcester, and the success of Monk in Scotland, which left the English government at leisure to follow the dictates of its resentment. The mere gratification of revenge, in a national sense, being a poor motive for war, it has been thought that the enemies of Cromwell sought to promote it, in hopes that such great expenses at sea might lead to the reduction of the army, which was visibly conducting him to the summit of power on land. On the other side, it has been argued, that Cromwell himself promoted the war in order to retain the very army it was thus proposed to reduce; which contradiction only proves that nothing is more vague and inconsistent than conjectures respecting the designs of artful politicians. The real state of the case probably was, that Cromwell deemed it necessary to lower the naval predominance of the Dutch; and to defeat their grasping endeavours at a commercial monopoly. The latter of these objects was still more effectually promoted by the celebrated Navigation Act, which prohibited the importation of all foreign commodities, except in English bottoms, or in those of the country where the goods were produced. By this Act, which took place the first of December, 1651, the parliament quietly transferred a large share of the carrying trade from the Dutch shipping to that of Great Britain, and effected a most serious blow by an apparently simple and domestic regulation.* Parliament also granted letters of marque to those merchants, who complained of Dutch aggression, so that it soon became evident to the government of the United Provinces that war was resolved upon.

The conflicting authorities of the English and Dutch historians, leave it doubtful to this day which of the countries was really most anxious for war; for there is much plausible evidence to show, that jealous of the rising spirit and energy of the English Commonwealth, the Dutch were resolved to strike a blow that might cripple its navy and lessen its increasing reputation. But whatever was the real inclination, on either side, as if conscious that it could scarcely be vindicated, each party was solicitous to throw the odium of commencing the war upon the other. On the passing of the Navigation Act, therefore, the Dutch sent an embassy to London, which was received with great apparent respect; but instead of a revocation of the Act complained of, the Dutch ambassadors encountered a formidable recapitulation of all the injuries received from the United Provinces, at Amboyna, in India, Persia, Muscovy, Greenland, and other places, for the last thirty years, terminating with a demand of 1,700,000*l.* by way of reparation. The murder of Dorislaus was also adverted to; and satisfaction required for

* Hist. of the Rebellion, vol. iii. p. 229.

* The policy and expediency of this measure were as evident at the time, as the necessity of some relaxation has been since. Possibly one of the most useful accomplishments for a modern politician is the art of discovering, when that which was once wise is wise no longer.

the omission of all steps against the assassins. On compliance with these claims, an alliance with the United Provinces was gravely proffered as before. These demands produced no surprise, for so little expectation had been formed of any pacific result from the negotiation, that the Dutch had been getting a fleet of one hundred and fifty ships of war ready for sea, during the absence of their ambassadors; and it now became certain that the first encounter of the respective national fleets, would terminate in direct hostilities.*

More space has been occupied in giving a due notion of the circumstances which led to the Dutch war, than usually belongs to the detail of historical events in biography, because it was desirable to exhibit the state of national feeling at the period when hostilities commenced. The nature of the rivalry with the Dutch came close home to the bosoms of a trading people; the pretensions of their navy must have still more forcibly assailed the pride and spirit of the seamen of a country, whose insular situation and previous exploits had marked it out for naval dominion. Blake was precisely a man to feel this stimulus in the highest possible degree; not to mention the strong republican notions of national glory, which he appears, in common with many other distinguished men of the day, to have owed to his classical studies. It was the great defect of Greek and Roman patriotism, that it would too frequently sacrifice not only justice, but the public interest, to advance the public glory. There is little reason to complain of Admiral Blake on this score; but it doubtless tended to conduct him to that general conclusion, which, in all the changes of the times, he continually impressed on his officers and seamen. "It is our duty," said he, "to defend the country, into whatever hands the government may fall;" or in still more characteristic phraseology, "under all circumstances, to prevent the foreigners from fooling us."

The ambassadors of the United Provinces were still in London, when a Dutch fleet of forty-five sail appeared in the Channel, under the command of Admiral Van Tromp, acknowledged to be one of the bravest and most experienced sea officers in Europe. The pretended object of this squadron was to convoy some merchantmen; but it most unnecessarily anchored in Dover Roads, and from the circumstances which followed, apparently with a design to provoke hostilities. A small squadron of eight ships being then in the Downs, under the command of Major, afterwards Rear Admiral Bourne, that officer sent to know the reason of this unusual demonstration. Van Tromp pleaded stress of weather; which excuse being evidently untrue, Blake was ordered to the Downs, with such ships as were ready. On the appearance of the English fleet, Van Tromp weighed anchor, and bore up to it nearer than was necessary, and that too without striking his flag—the mark of homage which had always been paid to England in the narrow seas. To remind him of the expected salute, Blake fired a gun without ball; on which Van Tromp is said to have also fired a single gun on the contrary side, as if in derision. Blake fired a second, and then a third gun, on which Van Tromp answered with a broadside. Perceiving that it was the intention of the Dutch to fight, Blake advanced with his own ship, to discuss with Van Tromp the point of honour, and by explanation to spare the effusion of blood; but the latter cut short all negotiation, by firing a broadside into the English Admiral's ship, which, it is said, shattered his cabin windows. Blake was extremely incensed at this insult, and quickly ordered his men to answer the Dutch Admiral in his own way; but his anger evaporated in a somewhat coarse sea joke, "he took it very ill of Van Tromp that he should take his ship for a brothel, and break his windows." Blake singly sustained the brunt of the attack, until the remainder of his fleet and the squadron of Major Bourne could join him, when the fight became general, and lasted from 5 o'clock until night. In this engagement, which took place on the 19th of May 1652, the Dutch, notwithstanding their numerical superiority, appear to have lost two ships; and the advantage, although not otherwise of much moment, was decidedly in favour of the English.*

As each of the admirals had been directed, if possible, to place the blame of commencing hostilities upon the other, Van Tromp, in his official des-

* Rapin's Hist. of England, 8vo. edit. vol. xi. p. 60. Campbell's Lives of the Admirals, vol. ii.

* Heath's Chronicle, p. 319. Lives, English and Foreign, vol. ii. p. 99.

patch positively asserts, that he backed his sails and lowered his flag to the British Admiral, who nevertheless fired the first broadside, and wounded several of his crew;* while, on the other hand, Blake's letter as expressly states the contrary. It is difficult to doubt the assertion of an individual so personally honourable as Blake; and it appears that his conduct was fully justified by a report from the Council of State at home, as well as by the popular feeling, which was so much irritated, that it became necessary to grant a guard to the Dutch ambassadors, who attributed the engagement to accident and misconception on both sides. The States sent another envoy, ostensibly to effect a pacification; but the parliament persisting in the same high tone as before, the United Provinces at last recalled their ambassadors, and prepared for a continuation of the war. Both sides issued manifestoes on this occasion; the Dutch to demonstrate that they were attacked without provocation, and the parliament to recapitulate the preceding grievances, to which was now to be added the refusal to strike the flag. To this demand the States had pleaded, that although the Republic, in its infancy, had paid that compliment to the *royal* dignity of England, they did not hold it due to the Commonwealth. A more indiscreet plea could scarcely have been advanced, to men of the character of those who then ruled the destinies of England; and accordingly it was determined to maintain the national honour at all hazards. "But after all," continues Rapin, with great simplicity, or rather with that conventional language, which it is so usual to apply to commonplace political falsities, "this was by no means the true ground of the war; but these manifestoes were *necessary* to vindicate the rulers of both Republics, and to impose a belief on the subjects, that they were not plunged into these extraordinary expenses to support a war, without the most evident necessity."† That is to say, the people were to be deluded into the supposition of a necessity which did not actually exist. It is gratifying to feel assured that this species of delusion, at least, becomes every day more impracticable; and that it is only necessary for the people to be thoroughly convinced of the atrocity as well as folly of war undertaken upon any but the most solid grounds, to render it wholly impossible.

The fleet of Blake was rapidly reinforced by the personal exertions of Cromwell and Bond, who repaired to Dover to consult with him on the subject. Some time elapsed before it was in a condition to meet that of the Dutch, which soon amounted to seventy sail; so vigorous were the exertions of those Republicans to obtain a naval superiority over the English. In about a month, Blake deemed himself strong enough to meet the enemy; and, aware of the arduous nature of the expected conflict, he proclaimed a solemn fast and day of humiliation, which both officers and seamen were called upon to observe. The two main fleets, however, did not encounter each other so soon as was expected; and in the mean time, the admiral most effectually exerted himself to annoy the Dutch trade. He then sailed with a strong squadron northward, and in less than a month, captured thirteen Dutch ships of war, being the whole of their Herring convoy. With great and considerate humanity, however, he did not destroy the fishing vessels, but only claimed the tenth Herring, the former tax, for the liberty of fishing on the British coast; nobly declaring his reluctance to waste so much food, to the probable hunger and distress of thousands.*

## Chapter III.

*Return from the North—Engagement with and Defeat of De Witt and De Ruyter—Exertions on both sides—A great Force placed under the Command of Van Tromp—Inferiority of the English Fleet under Blake—Result of the ensuing Engagement—Vain Glory of Van Tromp—Quick Recovery of Superiority by the English—Series of Engagements with the Dutch—Behaviour of Blake and his Colleagues on the turning out of the Long Parliament—Cromwell assumes the Protectorate—Peace with the Dutch.*

Blake returned from the north with his prizes, and 900 prisoners; and reached the Downs on the 12th of August, 1652, where he was joined by several more ships; and his fleet being now

* La Vie de Tromp, p. 17.
† Rapin's Hist. of England, vol. xi. p. 62.

* Lives English and Foreign, vol. ii. p. 101. Campbell's Lives of the Admirals, vol. vi.

sufficiently strong, he steered over to the Dutch coast. During this cruise he fell in with a French squadron, proceeding to the relief of Dunkirk, and on account of some hostile proceedings at Newfoundland; he captured and carried it into Dover, by which means the former town fell into the hands of the Spaniards. On the 28th of the following month, of September, he met the Dutch fleet, under the command of De Ruyter and De Witt, who, in consequence of the popular dissatisfaction with Van Tromp, in Holland, had succeeded that officer. When Blake discovered the Dutch, he had but three of his ships with him, Vice Admiral Penn's squadron being at some distance; and the remainder of the fleet a league or two astern. He, however, bravely bore in among them, and being soon admirably seconded by the divisions under Penn and Rear Admiral Bourne, the fight began with great animation; and lasted until night, by which time the Dutch saw their Rear Admiral captured, and three other ships destroyed. Blake would have renewed the fight the next day, but the Dutch made all the sail in their power, and reached Goree. The English lost but few men, and not one ship, while the Dutch fleet landed more than 2000 wounded; the disadvantage, according to De Witt, being caused by the cowardice, or disaffection of his captains, irritated by a great arrear of pay and the unprofitable nature of the contest*.

The impolicy of such a war, on the part of a commercial people like the Dutch, was by this time apparent; for Blake, with his usual activity, had made use of his success, so as to annoy their trade in all quarters. The ill humour created by their losses vented itself with great asperity upon De Witt, who was in another way unpopular, from his republican opposition to the ascendancy of the House of Orange. On his return to Flushing, a tumult ensued; and so much disappointment was expressed, that De Ruyter was anxious to resign his commission, and De Witt took to his bed from pure chagrin. Considerable pains were taken by the States to remedy the late disasters; commissioners were appointed to inquire into the conduct of the offending captains; and the fleet being refitted, was once more put under the command of Van Tromp. The English, on their side, were equally active; an act was passed by the Parliament, requiring all English seamen to return home in forty days, and such as were in India in twelve months: it also directed that all English carpenters, shipwrights, and other efficient artisans found on board the enemy's ships, should be thrown overboard without mercy. In point of fact, the war was essentially injurious to both countries; except upon that inhuman theory, which holds occasional warfare to be necessary as a species of exercise, and national prosperity to rest securely on established ascendancy alone. Were the power of self-preservation exclusively implied by this doctrine, it might be difficult to controvert it; but unhappily ascendancy in all its guises is disposed to be aggressive, and the power to oppress is almost invariably followed by the inclination. It must, however, be admitted, that the welfare of Great Britain is so intimately connected with naval superiority, that it is difficult altogether to condemn a course of proceedings which has materially conduced to it. Such was certainly the case with this otherwise profitless warfare. Whatever may now be thought of the motives on both sides, the merit of Blake will remain the same: if the contest was necessary, he carried it on with triumphant vigour, and ultimate success; and even if impolitic, he still rendered it as beneficial as it could be made, by the energy and spirit which he infused into the sea service, and the manner in which he made it redound to the honour of the English name.

Nothing is more remarkable during this war, than the transient superiority acquired on either side; at least as regards the number of ships employed, and the power of riding paramount on the high seas. This was partly owing to the smallness of the vessels of war, as compared with such as are now admitted into the line of battle.* Ships

* Whitelocke's Memorials, p. 5-6. Ludlow's Memoirs, vol. i. p. 428. Heath's Chron., p. 526.

* The comparative ease with which this could be effected, will be apparent when it is understood that at this time any merchantman, capable of carrying guns, could with a few alterations be converted into a man of war. It appears on the authority of the Parliamentary Journals of 1651, containing a list of merchantmen thus altered for the navy, that a vessel of 900 tons burthen could be made a man of war of 60 guns; and those of 700, 400, 200, 100, and 60 tons, rendered ships of war respectively, of 46, 34, 20, 10, and 8 guns; five or six men being allowed for each gun. It is further to be observed, that naval battles were not then fought in line, the first engagement of that description being the celebrated sea fight of the third of June, 1665, in which the Duke of York, afterwards James II., gained a victory over the Dutch Admiral Opdam, whose ship was blown up in the conflict. James, in

could then be prepared and manned with very great celerity, and consequently when exertion became necessary, a strong numerical force was quickly collected. The defeat of De Witt and De Ruyter stimulated the United Provinces to strain every nerve to regain the advantages which they had lost; and Van Tromp again appeared in the Downs in the command of a fleet of fourscore men-of-war. His purpose was to seek Blake, of whose deficiency of force he was probably well informed: the English Admiral had not only been ordered to weaken his fleet by despatching large detachments on different services, but it has been asserted that the Parliamentary Committee, having by this time become jealous of all their great commanders, were careless of repairing the damaged ships, or of expediting the necessary supplies. From some, or all of these causes, it happened that Blake had only forty ships under him, when Van Tromp appeared at the back of the Goodwin Sands, where these two valiant chiefs had fought before; a choice of position which, it is supposed, he meant to be understood as a sort of national challenge.

Blake placed, by orders from home, in this mortifying state of inferiority, immediately called a council of war, when it was decided that a battle should be hazarded, under all disadvantages. Dr. Johnson, in his life of Blake, blames this resolution as exhibiting more of the rashness of a private soldier, than the wisdom of a commander. Something, however, must be allowed for the reluctance of a man of invincible spirit, to endure a second insult from the same adversary; and probably still more to the state of party at home, where a faction was anxious to lower his popularity. Nor is it quite clear that in a national point of view, more might not have been lost by declining an engagement than by risking a defeat without dishonour. Van Tromp might undertake with a strong and uncrippled fleet, what he would have been unable to effect after a dear-bought victory. At all events, it is to this daring spirit that the English navy owes its high character; and it is scarcely correct to judge of master minds by maxims applicable only to the mediocrity of talent possessed by the great mass of mankind.

After the determination to fight had been taken, the engagement would have commenced immediately, but for a change of wind, which postponed it until the next day. Early in the morning both fleets plyed a little to the westward, the English having the weathergage; and about noon the action began. It appears, that beside the great disparity in numerical strength, the English fleet was so poorly manned, that a great part of it could not engage at all, so that a few ships bore the brunt of the action. Of these the principal were the Victory, the Vanguard, the Garland, and the Triumph, the admiral's own ship. The action lasted until night, a short time previously to which the adventurous captain of the Garland, of forty guns, made a bold attempt to board the ship of Van Tromp, but fell in the attempt, which led to the capture of his own vessel. The Bonaventure, endeavouring to relieve the Garland, was also captured, after the fall of its commander. Blake himself was boarded

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his "Life," attributes the introduction of the naval line of battle to himself; and if so, it does considerable honour to his professional skill, having been practised without variation by all our great admirals, until Lord Rodney was induced by Clark's "Essay on Naval Tactics," to adopt the manœuvre of breaking the line in his celebrated engagement with Count de Grasse. The following abstract is condensed from an elaborate list of the British navy, as it existed in 1675, about twenty years after the death of Blake. It is made up from a document in the handwriting of the eccentric sea-chaplain Henry Teonge; and from a similar statement, supplied to the House of Commons in the same year, both appended to Teonge's published diary. According to these authorities, the navy then consisted of—

8 First-rates, of from 100 to 90 guns, varying in tonnage from 1556 to 1102 tons, in length from 137 to 122 feet, and carrying from 550 to 850 men;
9 Second-rates, of from 84 to 64 guns, varying in tonnage from 1032 to 663 tons, in length from 120 to 110 feet, and carrying from 530 to 410 men;
22 Third rates, of from 74 to 56 guns, varying in tonnage from 978 to 417 tons, in length from 127 to 107 feet, and carrying from 500 to 340 men;
37 Fourth-rates, of from 60 to 40 guns, varying in tonnage from 657 to 354 tons, in length from 110 to 83 feet, and carrying from 300 to 170 men;
15 Fifth-rates, of from 40 to 28 guns, varying in tonnage from 366 to 180 tons, and carrying from 150 to 100 men;
8 Sixth-rates, of from 20 to 4 guns, varying in tonnage from 194 to 35 tons, and carrying from 80 to 45 men;
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With 49 sloops, doggers, smacks, yachts, fireships, &c. &c., carrying from 12 to 2 guns, and collectively manned by 1401 seamen.

It will be perceived that there is much discrepancy between the rates of tonnage of many of the vessels, and the number of guns which they carried—a fact to be accounted for on the presumption that adapted merchantmen could not always be made to carry guns in proportion to their tonnage; or that very different weights of metal are referred to. Of the foregoing ships, which are rated as in the original documents, one first-rate, six second-rates, eleven third-rates, twenty-six fourth-rates, one sixth-rate, and four smaller vessels—in all forty-nine, alone existed before the Restoration; which shows the rapid increase of the navy in the brief interval of fifteen years.

twice, and but for the brave manner in which he was supported by the Vanguard and the Sapphire, he would have fallen into the hands of the enemy. Beside the two ships taken, another was run ashore, and the entire fleet was so shattered, that had not night favoured their retreat, the consequences might have been still more disastrous. As it was, they were enabled to reach the Thames, and thereby defeated the intention of Van Tromp to assail them the next day with fire-ships, and complete their destruction. One of the Dutch flag-ships was blown up; and those both of Van Tromp and his vice-admiral, De Ruyter, were so damaged, as to require immediate laying up. This unequal contest lasted from eight in the morning of the 29th November, 1652, to six o'clock in the evening*.

The Dutch admiral, puffed up with this momentary advantage, was so vainglorious as to sail through the channel with a broom at his mast-head, to signify that he had swept away the English from that sea; and the populace of the United Provinces equally elated, with the usual presumption of success, talked of capturing the whole of the English West India islands†.

The emptiness of the bravado of Van Tromp, and the futility of the expectations of his countrymen, were soon made apparent; for in about two months Blake, with whom, at his own request, Monk and Deane had been joined in commission, was enabled to repair and fit out a fleet of eighty sail of ships of war. With these they quickly sought and again encountered Van Tromp, who, with a fleet of seventy sail of vessels of war, and no less than three hundred merchant ships under his convoy, was returning up the Channel from the Isle of Rhé. Blake commenced the action off Portland with twelve ships, led by himself in the Triumph; and so warm was the conflict, that his own ship received no fewer than seven hundred shots in her hull, and might have been sunk but for the timely relief afforded by Captain Lawson in the Fairfax. In this action, which took place on the 18th February, 1653, Blake lost his own captain, a distinguished veteran named Ball, his secretary Mr. Sparrow, and received himself a grievous wound in the thigh. As usual, the fight lasted until night, when the Dutch, who had six men-of-war sunk and taken, retired. Blake, after sending ashore his sick and wounded men, pursued the enemy; and for the two following days occasional encounters took place, in which both sides fought with extraordinary fury. At length the Dutch fleet reached the sands of Calais, where they anchored, and, favoured by the light draft of water of their shipping, they were enabled safely to tide it home. In these engagements the Dutch lost eleven ships and thirty merchantmen; and, according to their own accounts, full 1,500 seamen. The English lost only one ship; but the number of seamen killed and wounded was equal to that of the enemy. It is recorded, that being short of hands, Blake had embarked some regiments of soldiers on this occasion, who contributed greatly to the victory, and most probably their evident utility led to the establishment of regular corps of marines.

Towards the end of the following April, Blake and his former colleagues, with a fleet amounting to a hundred ships of war, attacked a Dutch fleet of seventy sail on their own coast; and, after capturing fifty doggers, drove them into the Texel. They then sailed northwards in search of Van Tromp, who with a rich fleet of merchantmen under convoy, having deemed it hazardous to enter the Channel, had steered round the north of Scotland. With great dexterity that able seaman contrived to escape the three English admirals, and to lead his merchantmen safely into port; a very beneficial service, but almost ludicrously contrasted with his former "top gallant humour," as one of the writers of the period has called it, of sweeping the British shipping from its own seas.

At length, convinced of the absolute necessity of again bestirring themselves with energy, the States enabled Van Tromp to put to sea, with a fleet of one hundred and twenty ships; and on the third of June he came into contact, off the North Foreland, with the English squadrons under Monk and Deane. Almost in the beginning of this engagement, Deane, a commander of distinguished reputation, was carried off by a cannon ball; and although, after a conflict of six hours, the Dutch retired, the success was but equivocal. The arrival of Blake on the fourth, with eighteen fresh ships, turned a partial advantage into a complete victory. Of the Dutch fleet six were sunk and eleven captured, and the number of prisoners amounted

* Lives English and Foreign, vol. ii. p. 104.
† Heath's Chronicle, p. 381.

to 1350, of whom six were captains. The English, on the contrary, lost not a single ship, while the number of killed and wounded fell short of 260. In this battle Van Tromp boarded the English vice-admiral Penn, but was not only beaten off, but himself boarded in return, and he would have been taken but for the timely assistance of his colleagues, De Witt and De Ruyter. It was, in fact, only by retiring once more among the flats and shallows of the Dutch coast, that Van Tromp was enabled to save the greater part of his fleet.*

The discontent of the people of the United Provinces during these successive defeats and mortifications was extreme; and the alternate despondency and presumption which they displayed, afford a very instructive lesson to those politicians who work on the popular feeling, and lightly employ the ignorance, the prejudices, and the inconstant passions of the multitude. What beyond a candid and patriotic appeal to the actual interests of the people can the honest statesman require? Upon any real emergency would such appeal be less forcible or the motives to exertion less earnest? Who in the long and vague annals of history, abounding as they do with the crimes and errors of the human race, but must perceive the readiness with which men usually answer the calls for sacrifices, when absolutely and evidently necessary? Where is the country whose records do not contain many more examples of brave and patriotic devotion in cases of urgent need, than of shameless and pusillanimous self-abandonment? It is however fair to remark, that rulers often participate in the errors which they propagate; and many a ruinous course of policy has been pursued with a firm conviction that it was just and necessary. Knowledge, then, on both sides is the only corrective: on that of the ruler, that it may not err with good intentions; and on that of the people, that they may discountenance every injurious appeal, whether the motives in which it originate be insidious or sincere.

While these contests were taking place at sea, an important change was effecting in the government at home. In the month of April, 1653, Cromwell turned out the remnant, or, as it has been usually termed, the Rump of the Long Parliament, and took measures for the assumption of supreme power. The States and the Royalists looked forward with great anxiety to the manner in which the fleet and its commanders would receive this bold act of usurpation. Whatever hopes they might have formed were quickly terminated by the publication of a formal declaration from Blake, Deane, Monk, and the rest of the sea officers, that notwithstanding the recent changes, they felt that their duty, and the national trust reposed in them, required a continuance of their exertions against the foreign foes of the Commonwealth. Blake, on this occasion, emphatically expressed his often quoted opinion, that it was not *their* business to mind state affairs, but to prevent the enemy from taking advantage of our domestic disputes. "Remember," said he, "that we are Englishmen, and that our foes are foreigners."* The unsophisticated good sense of Blake perceived that a maintenance of the British ascendancy at sea, was equally necessary under every sort of sway; and that it was not for foreigners to profit by our dissensions, however they might originate, or to whatever they might conduce. At the same time, he had the less temptation to act otherwise, as the Parliament had, by this time, become exceedingly unpopular with the nation, in consequence of a design to perpetuate themselves being strongly suspected by all parties. The same jealousy, whether well founded or not, had been manifested by the Parliament towards the officers of the navy as to those of the army, which rendered them indifferent to a change, whatever they might think of the character of that which took place. As to Blake himself, he was probably too sincere a Republican to approve cordially of the approaching exaltation of Cromwell; for although on his return home in ill health, immediately after his last victory, he was appointed a commissioner for Somersetshire, in the Mock or *Little Parliament*, and was otherwise much consulted, it was so exclusively in relation to naval affairs, or foreign warfare, that his name stands perfectly clear of every shadow of imputation of cabal, or intrigue. On this account, as already intimated, he was regarded with respect by the most opposite parties; all of whom beheld in him a spirited and dis-

* Blake and Monk's Despatch.

* Fasti. Oxon. vol. i. Coll. 204. Lives English and Foreign, vol. ii. p. 109.

interested defender of his country, and an honour to the English name.

Before the health of the admiral was sufficiently recovered to go to sea again, the fleet commanded by Monk fought the famous battle with that of the United Provinces, which terminated in the death of Admiral Van Tromp, and in a bloody and dear bought victory by the English. Although not present at this engagement, which took place on the 29th, 30th, and 31st of July, 1653, Blake had assisted so much in getting the force equipped, and by his counsel generally, that parliament decreed him a gold chain in common with the other admirals; and in the following October, when he came to London and took his seat in the House of Commons, he was solemnly thanked for his many and important services.*

The formal assumption of the Protectorate by Oliver Cromwell distinguished the close of the year 1653, in which arrangement Admiral Blake appears rather to have acquiesced than assisted. This event was followed by a peace with the United Provinces, with whom negociations had commenced soon after the battle in which Van Tromp lost his life. The terms of this treaty, which was signed in April, 1654, were highly honourable to England: the Dutch gave up every thing they had professed to fight for, although, in the exaction of some of our claims, there is reason to believe that, satisfied with the honour of maintaining them, Cromwell was not very rigid in their precise fulfilment.

Such was the result of the first of those struggles with the Dutch for naval dominion, which were so uselessly renewed after the Restoration, and which, as far as that direct species of rivalry was concerned, terminated at the Revolution of 1688. To the naval superiority obtained by the English, since that remarkable period in the annals of both, it is scarcely necessary to allude, except, perhaps, for the sake of remarking that while struggles for mere glory are unprofitable at best, they are still more unadvisable, where fluctuating sources of prosperity are called into a contest with great physical superiority, and higher natural advantages. Such was the case with the United Provinces, as compared with Great Britain; to say nothing of the strong motives to a friendly union between them, as regarded the more formidable foes of both. The two powers have since been frequently at war; but on which ever side the provocation has originated, the result has always been most injurious to the States. It must not be presumed, for a moment, that the foregoing argument is advanced with a view of deprecating those glorious contests with powerful tyranny and oppression, like that which released the United Provinces from the yoke of Spain, or in objection to such exhibitions of national spirit and just jealousy for the honour of the country, which are essential to its independence. Here danger may be nobly incurred, and sacrifices justly as well as wisely called for; but how few are the wars of this description, compared with the number of unnecessary conflicts produced by illiberal jealousy, venal intrigue, and personal ambition! However visionary those ideas of perpetual peace may be, which ardent and benevolent minds persuade themselves may be realized, we surely may cherish the hope that the unholy and indefensible warfare, to which we are alluding, will necessarily decrease, in proportion to the diffusion of information among the great mass of mankind.

## Chapter IV.

*Expedition to the Mediterranean—Respect paid to Blake by the Officers of France, Spain, and Holland—Negotiation with the Dey of Algiers—Chastisement of the Bey of Tunis—Redress exacted for injuries and insults to the English in the Mediterranean—Respect paid to the Protector by the Italian States—War with Spain—Expedition to Cadiz—Illness of Blake—Exploit at Santa Cruz—Behaviour of the Admiral in respect to Captain Blake—Sails for England—Death—Funeral Honours—Treatment of his Remains at the Restoration—Character.*

In the first parliament called by Cromwell, in September, 1654, Blake was once more chosen to represent his native town of Bridgewater; but, although by the peace with the United Provinces, the necessity for naval exertions was much abridged, the mistaken policy * of Cromwell having decided on

* Lives, English and Foreign, vol. ii. p. 109. Winstanley's English Worthies, p. 555.

* Cromwell had not the merit of perceiving the rising ascendency which the genius of Cardinal Richelieu had been preparing for France; and, consequently, was unconscious how much his decision against Spain, in furtherance of the ambitious views

a war with Spain, he was soon called again into active service. The known attachment of the admiral to republicanism has been alleged on this occasion also, as the cause of his appointment to the command of a fleet; but surely, having determined upon hostilities, the selection of the most eminent seaman in the country seems only to have been a matter of course.

In the first instance, however, Blake was despatched in November, 1654, with a formidable fleet into the Mediterranean, to support the honour of the English flag, and to procure satisfaction from the Barbary Powers, for their many acts of piracy against British merchantmen. This expedition was sent out before war was declared against Spain; so that in the ensuing December his fleet entered the port of Cadiz, where he was received with all imaginable respect. This, no doubt, was partly owing to the anxiety of the Spaniards to keep well with the Protector; but no small portion of homage was excited by the known talents and high achievements of the gallant commander himself. Aware of former consequences, a Dutch admiral would not hoist his flag while Blake remained at Cadiz; and a French squadron having stopped one of his tenders, which had been separated from him in a storm, the commander, as soon as he knew to whom he belonged, sent for the captain on board the flagship and drank Blake's health in his presence, under a discharge of five guns.* The Algerines were likewise so daunted by the terror of his name, and so apprehensive of his designs, that, of their own accord, they stopped the Sallee Rovers and made them give up what English prisoners they had on board, which they sent freely to the admiral without ransom. These concessions, however, did not prevent him from sailing to Algiers, where he appeared on the 10th March, 1655, and sent an officer on shore to demand the release of all English captives, and ample satisfaction for the piracies committed on the British trade. The Dey, who seems to have known the best manner of soothing a temper like that of Blake, pleaded his inability to release ships and captives which had become private property, without producing a mutiny; but the latter he agreed to give up on a moderate ransom per head, and offered to make such a peace with England as should prevent all future hostilities. He accompanied this answer with a large supply of provisions, and for the present, Blake appeared satisfied. It is not unworthy of remark in this place, that these maritime plunderers have continued, in a similar manner, the objects of alternate chastisement and negociation to this hour, when a leading European nation has a fleet before Algiers, on an errand precisely of the same nature as that of Blake's, upwards of one hundred and seventy years ago. It is melancholy to reflect, that a fine and extensive coast like that of the north of Africa, once, too, the seat of great comparative civilization, should have been allowed to remain in the possession of successive hordes of incurable pirates, insolent and rapacious by turns to all Christendom. If endured, because dangerous plans of national aggrandisement might follow their destruction—what a satire upon the moderation of the great Christian powers! If acquiesced in by some nations because a greater injury is inflicted upon others — how discreditable such motives to religion and humanity! Under every view of the case, the long toleration of this nuisance is a disgrace to civilized Europe.

From Algiers, the admiral sailed to Tunis, the Bey of which, relying upon the strength of his fortresses, returned an insolent answer to the message of Blake, and even refused to allow him to supply himself with fresh water. "Here," said the barbarian, "are our castles of Goletto and Porto Ferino; do your worst: do you think that we fear your fleet!" On receiving this hasty reply, the Admiral immediately bore away into Porto Ferino, with his first and second rate ships. He reserved his fire until they had approached within a musket shot of the castle and line of fortifications, when he opened his guns so effectually upon both, that in two hours the castle was rendered defenceless, and the guns on the works along the shore were nearly all dismounted, although no less than sixty had played on the English fleet at one time. Nine ships were lying in the harbour, and Blake ordered every captain,

of that power, would prove nationally injurious. The arrogant spirit of encroachment, displayed by Louis XIV. in the succeeding half century, rendered this impolicy very conspicuous. But a Spanish war was more popular, and, looking to immediate consequences, more profitable than a French one.

* Lives, English and Foreign, vol. ii. p. 114.

including even the captain of his own ship, to proceed in their long boats, with chosen crews, and destroy them. This was accordingly executed, with the loss of only twenty-five men killed, and forty-eight wounded, while the Admiral and his fleet covered the assailants from the fire of the castle, by playing continually on it with their cannon. This daring action spread the terror of his name, and produced concessions with very little trouble from the Bey of Tripoli; after which, he again returned to Tunis, where he now met with nothing but submission. As the purpose of this expedition was to procure satisfaction for all the injuries and spoliation suffered by the English in the Mediterranean, during the civil wars, when it was thought they could be inflicted with impunity, several of the minor Christian powers, who had taken similar liberties, were next called to account. Among the rest, the Knights of Malta were obliged to submit to reparation, as also the Duke of Tuscany, who was compelled to pay 60,000*l*. as a compensation for losses sustained from his subjects by the English. It is added, that the Admiral sent home no less than sixteen ships, laden with effects thus exacted, for insults and injuries endured by English subjects in that sea, during the political struggles which had harassed their country at home.*

These exploits were performed in the spring of 1655, and such a formidable opinion did they create of the power, strength, and tenacity of the English government, that most of the states of Italy thought proper to send messages of compliment to the Protector; and the Grand Duke of Tuscany and the states of Venice, in particular, distinguished themselves by splendid embassies. It is, in fact, difficult to select a period in English history, when the country was so feared and courted, as under the Protectorate of Oliver Cromwell. Some of this deference was, no doubt, attributable to the political situation of Europe at the time, but no small part was due to the great abilities of the Protector, and to the vigour and efficiency of his councils. His instruments too, as in the instance of Blake, were well chosen; and as, by the depression of the ancient aristocracy, he was called upon for few or no sacrifices to family support and connexions, so he had no occasion to give employments to persons who were unfit for them. He was indeed one of those master spirits, who can employ ability without fearing it—a faculty exceedingly rare, even among able rulers.

By this time, the secret expedition, under Penn and Venables, sent by Cromwell to surprise and capture St. Domingo, and which terminated in the taking of Jamaica, had become known to the court of Madrid, which immediately confiscated all the English property in Spain; and the war between the two countries was from that time carried on with extreme vigour and animosity. Blake, of course, did his best to ruin the maritime force of Spain in Europe, as Penn was endeavouring to do in the West Indies; and so great and incessant was his activity, that his constitution began to sink under efforts so unremitting. Fearing that some bad consequences might ensue, if he were not joined by a colleague, proper to take charge of the fleet, in the event of his decease, he suggested the expediency of joining some able commander in the commission with himself; in compliance with which suggestion, Admiral Montague was sent out, with a strong squadron to reinforce and assist him. Soon after the arrival of Montague, they repaired, with the joint fleet, to Cadiz in 1656, where they continued to blockade a Spanish squadron for several months. The Admiral then having taken the major part of his fleet to the coast of Portugal, to obtain water and refreshments, Captain Stayner, who had been left cruizing with a small squadron, fell in with the Spanish homeward-bound Plate fleet, and captured the Vice-Admiral, Rear-Admiral, and another galleon, with two millions of dollars on board; all which prizes, together with the prisoners, were sent to England, under Montague; Blake, notwithstanding his illness, remaining in the Mediterranean.

The maladies with which this indefatigable officer was afflicted, were the dropsy and the scurvy, which now began to make dreadful ravages in his constitution; yet his spirit remained unabated; and being informed that another Plate fleet had put into Santa Cruz in the island of Teneriffe, he sailed thither in the month of April, 1657, with a fleet of twenty-five men-of-war. He arrived in the offing of Santa Cruz on the 20th, where he discovered

* Hist. of the Rebellion, vol. iii. p. 580. Heath's Chronicle, p. 366.

six heavy galleons and ten smaller ships moored close to the shore, with their broadsides towards the sea, the inner vessels secured by a boom, and all disposed in such a manner as to present the appearance of being almost unassailable. Nothing seemed to have been omitted by the Spanish commander, a man of courage and conduct, to render a successful attack impossible. The ships were defended not only by a strong castle in a very commanding situation, and furnished with heavy ordnance, but seven additional forts had been erected, mounting from three to six guns each, and united by lines of communication, manned by musketeers. Yet, notwithstanding these able dispositions of the Spanish General, such an idea was generally entertained of Blake's enterprising character, that the captain of a Dutch merchantman, then in the bay, at once made up his mind, from the manœuvres of the English Admiral, that an attack was intended; and to avoid ill consequences to himself from the approaching conflict, he immediately waited upon the Spanish Commander, and requested leave to quit the harbour, plainly stating as his reason for the request, his conviction that Blake would be soon among them. The resolute Spaniard at once granted him the desired permission, exclaiming with a confident smile—"Get you gone, if you like, and let Blake come if he dare."*

The Admiral had by this time settled the question of daring, having made all his dispositions for the attack. A squadron of ships was selected for the first onset, commanded by Captain Stayner, in the Speaker frigate, who proceeding directly into the bay, assailed the Spanish fleet with extreme fury, perfectly regardless of the guns of the forts which played on his ships in every direction. Another division of the fleet was judiciously sent to occupy the attention of the castle and the forts, while Blake himself joined Stayner, and attacked the Spanish ships, which were not much fewer in number than the English, while the crews greatly exceeded them. Notwithstanding this advantage, in a few hours the Spaniards were driven entirely from their shipping, and Blake, who perceived the impossibility of carrying the vessels out, ordered his men to set fire to their prizes. This was done so effectually, that all the Spanish ships were reduced to ashes, except two, which sank during the engagement, and exhibited only a small portion of their masts above the water.*

It is necessary to mention a circumstance which has exposed this celebrated affair to much professional remark, both at the time it occurred, and even since. It is stated that the direction of the wind which prevented Blake from bringing his prizes out, would have prevented him from getting out himself, but for its sudden veering to the south-west, a change of very rare occurrence at that time of the year. Should this latter assertion be true, it must be confessed that this daring attack wears the appearance of a trusting to contingency, or bare possibility, which must be deemed rash in the extreme, and so it has been frequently termed by authors of considerable reputation. Unhappily the gallant performer of the exploit died before he reached his native land, which deprived the world of his own explanation of the affair; but as the bay of Santa Cruz is open, without any difficulty in the egress, we cannot help suspecting, that the land breeze, which so timely carried him out, was not so unusual as here represented; and that he rested upon a feasible exertion of skill and seamanship, and not upon an interference in his favour so apparently special, that it might almost be deemed miraculous. The writer of the account whence we gather this narration,† directly attributes this change of wind to Providence, which leaves Blake's professional prudence in great jeopardy, as he could have scarcely looked forward to such an interposition. Is it not more probable, that a man, who united so much coolness and judgment to undaunted resolution, saw many things possible which were invisible to less gifted eyes? Blake never seems to have made any signal mistake in the whole of his naval career, for it has already been shown, that his attack of Van Tromp, with an inferior force, has by no means been proved to be either unnecessary or unadvisable. Other and more general reasons render it probable that the alleged critical change of wind was exaggerated in the narratives of the day. People like to seem indebted to the visible favour of Providence, and its

* Heath's Chronicle, p. 391.

* Heath's Chronicle, p. 391.
† Heath.

special protection was always very unequivocally claimed by that predominant English party to whom Blake's success was peculiarly acceptable. On the other hand, a taste for the marvellous is even still more prevalent; and simply as an extraordinary event, the more surprising the version of the story, the more would it be cherished by the multitude. In a word, it is difficult to believe that an officer of the high character and experience of Blake, would risk his reputation by an act which nothing but a most unusual phenomenon could prevent from being at once fatal to himself and injurious to his country.

Rapin, who seems never to have been cordial to the memory of this great seaman, on account of his success against the Dutch, remarks, that however heavy the loss to the Spaniards in ships, money, men, and merchandise, the English gained nothing by this enterprise, but glory.* Dr. Johnson however, tersely and justly observes, that in warfare an increase of military reputation is an increase of power, and that he who weakens his enemy, in effect strengthens himself.† As respects Spain, this was particularly the case, for her South American treasures had become the chief source of her power of annoyance. This is not to defend the vain glory of war, or to vindicate its barbarities: the more clearly indeed it is shown that havoc and destruction are inevitably connected with it, the more plainly is proved the wickedness of that policy which would wantonly inflict its horrors, or create artificial pretexts for the calamities which are its inseparable attendants.

To return to the Admiral: the union of skill and bravery in this transaction is forcibly evinced by the fact that the loss of the English amounted, in killed and wounded, to about 200 men only, without the destruction of a single ship. An affair, which must have been very afflicting to him, occurred in this battle, and the manner in which he acted in respect to it exhibits the clear and patriotic spirit of the man most characteristically. His brother, Captain Humphrey Blake, who commanded a ship for the first time, showed some lack of courage and talent as an officer,‡ which convinced Blake that he was altogether unfit for the profession of arms; and with the inflexible spirit of an ancient Roman, the Admiral immediately cashiered and sent him home. What adds to the fine spirit of this conduct is, that he continued to regard him kindly as a brother notwithstanding, and at his death left him his paternal estate. A stranger to fear himself, he was enough of a philosopher to be satisfied, that a constitutional temperament is not always to be corrected by the will; and that a man may be useful in the peaceable walks of society, whom it is impossible to stimulate into military ardour. His country, its service, and its renown, were preferred to everything else in the mind of Blake: those saved harmless, he was again enabled to indulge his domestic affections; and in all his dealings with vanquished enemies, he was uniformly one of the most humane and placable of men.

As soon as the news of this extraordinary piece of service reached England, the Protector sent his secretary to acquaint the Parliament, who ordered a public thanksgiving, and directed that a diamond ring of the value of 500*l.* should be sent to the Admiral. One hundred pounds were also voted to the Captain who brought home the news; and the thanks of the House were ordered to be conveyed to all the officers and seamen employed, by the mouth of their commander. As the affair of Santa Cruz was the concluding exploit of this valiant seaman, so the honours thus conferred upon him proved the last testimonials of respect that he was destined to receive from his beloved and grateful country. Returning towards the Mediterranean, after cruising some time before Cadiz, he discovered that his end was rapidly approaching, and became anxious to reach England. This, however, he was never again to behold, for he died just as the fleet reached Plymouth Sound. As he approached the Channel, it is said that he frequently inquired if the land was seen; but the exact circumstances attendant on his death are not recorded. He yielded up his gallant spirit on board the St. George, on the 17th day of August, 1657, having just completed his fifty-ninth year.*

The life and death of Blake will remind the reader of two distinguished Admirals of modern times:—the splendour of his career resembling the heroic Nelson's—and its close, that of the indefatigable and devoted Collingwood!

* Rapin, Hist. of Eng., English 8vo. edition, vol. xi. p. 96.
† Life of Blake in Gent. Mag.
‡ Lives, English and Foreign, vol. ii. p. 121.

* Mercurius Politicus, p. 375.

Nothing was wanting on the part of the Protector, the Parliament, or the people, to evince their high estimation of a man who had so ardently and disinterestedly devoted himself to the service of his country. The day after he died, he was embalmed and wrapped up in lead; his bowels were buried in the Great Church, at Plymouth, and his body sent round with the fleet to the Downs, and thence conveyed by water to Greenwich. There it lay in state, until the 4th of September, when it was borne up the Thames in a barge, covered with black velvet, and adorned with escutcheons and devices, to Westminster. Besides his brother, relations, and domestics, the funeral was attended by Oliver's Privy Council, the Commissioners of the Admiralty and Navy, the Lord Mayor and Aldermen of London, the Field Officers of the Army, and other persons of office or quality, who followed in a great number of barges and boats, covered with black cloth, and marshalled by the Heralds at Arms, who arranged the procession. On landing, they proceeded through a guard of several regiments of foot, drawn up to receive the procession at the Abbey; General Lambert, with whom the deceased had been on terms of great intimacy, being present. The procession having reached the Cathedral, the body was interred in a vault constructed for the purpose in Henry the Seventh's Chapel.* It is melancholy to be obliged to add, that at the Restoration the shadowy honour of an interment in the Abbey was no longer to be allowed to this great commander, whose body was dug up with those of Cromwell, Ireton, and many more. Some distinction was however made: the remains of Blake were decently reinterred in St. Margaret's Churchyard, while the bones of the others were treated with the greatest ignominy.† The propriety of this transaction as regards Blake was questioned at the time, even among the friends to the restoration; at present it will be regarded with unmixed disgust. The naval services of this valiant man were so truly national; he had done so much to render the power and character of his country respected, and in such strict accordance with the ideas entertained of public duty on all sides, that any manifestation of disrespect to the ashes of so illustrious a patriot, was as revolting to good feeling as to good policy. In every point of view, indeed, posthumous revenge is mean and disgraceful; and those who can derive satisfaction from insulting the remains of men, before whose ascendency they were forced to bend while living, only doubly proclaim their natural inferiority.

* Kennet's Register and Chronicle, p. 536.

† Neal's Hist. of the Puritans, vol. iv. p. 174. Grey's Examination of Neal's Hist., vol. iii. p. 318.

To the public and professional character of Blake the testimonies are numerous; and with a little abatement on the score of party feelings, nearly unanimous. It has been already remarked, that, in common with many other distinguished characters of the day, he appears to have formed his notions of patriotism from the republican models of antiquity.* Love of country, and devotion to its greatness, freedom, and independence, were, theoretically at least, the primary duty of every wise and virtuous republican of Greece and Rome; and Blake adopted that principle with a stoical firmness of soul, which enabled him to excel nearly the whole of his contemporaries in fulfilling his high notions of the sacrifices due from a patriot to the public good.

From the moment Blake entered public life, he never seems to have indulged in any sort of cabal or intrigue for political influence; the peculiar openness and sincerity of his conduct being vouched for by all who have written about him.† His freedom from every thing like a passion for acquisition, was equally conspicuous; for notwithstanding the immense sums which passed through his hands, so upright was his conduct as a public servant, that he scarcely left 500*l*. behind him, in addition to his paternal estate of about 200*l*. per annum. Love of fame may very possibly be thought to have been a considerable incentive: it might be so, but the love of fame is injurious only so far as it conduces to a selfish performance of extraordinary actions, with a view to mere personal no-

* The celebrated Hobbes was so impressed with the effect of the Greek and Roman historians and orators on the mind of the youth of the preceding age, that in the spirit of his opinions concerning passive obedience, he goes near to advise their total rejection in the education of Englishmen.

† The testimony given of this quality is peculiarly lively and spontaneous. "He (Blake) was," says Whitelock, "a man of as much gallantry and *sincerity* as any of his time, and as successful." Bates, although a very decided royalist, in his Elenchus Mortuum, is equally prompt in the praise of Blake's honour and frankness.

toriety; while, on the contrary, it may be deemed a salutary stimulus to ardent exertions in the fulfilment of duty. It is sufficient to ensure a high estimation of the character of Blake, that with the total absence of all views which, in the general opinion of mankind, are pronounced mean, selfish, or interested, he rendered the greatest services to his country; to advance whose welfare and reputation, formed the constant passion of his life.

As a warrior, both on sea and land, Blake forms a remarkable instance of the latent aptitude for a peculiar line of exertion, which may exist in men before they have any opportunity of displaying it. He was forty before the civil war broke out, and nearly fifty before he served at sea, and that as a commander at once. The mere fact of fighting ably and bravely at sea, would not distinguish him from many of his colleagues; but he no sooner stepped on ship-board, than he gave a new character to naval warfare, and made the most striking improvement in this important service, by the strength of his own genius, unaided by experience. The testimony of Lord Clarendon is unequivocal on this point, and it cannot be given better than in his own words.

"He (Blake) was the first man who declined the old track, and made it manifest that the science might be attained in less time than was imagined, and despised those rules which had been long in practice, to keep his ship and men out of danger, which had been held, in former times, a point of great ability and circumspection; as if the principal art requisite in the captain of a ship, had been, to be sure to come home safe again. He was the first man who brought the ships to contemn castles on shore, which had been thought ever very formidable, and were discovered by him to make a noise only, and to fright those who could rarely be hurt by them. He was the first that infused that proportion of courage into the seamen, by making them see, by experience, what mighty things they could do if they were resolved, and taught them to fight in fire as well as upon water; and though he hath been very well imitated and followed, he was the first that gave the example of that kind of naval courage and bold and resolute achievements."*

It is scarcely necessary to add, that the foregoing passage from a writer who cannot be suspected of partiality, is conclusive as to the high professional merits of Blake, who seems to possess an indisputable claim to the honour of having infused a great portion of that peculiar energy and spirit into the English navy, by which it has ever since been distinguished. The fact that both in his own days, and subsequently, he has been accused of rashness, will derogate but little from the justness of these pretensions. When a man of invention and enterprise ventures boldly, and is uniformly successful, it is both more generous and more just, to attribute the success to his superior capacity, than to dwell invidiously upon apparent temerity, or surprising good fortune. Every case no doubt is, strictly speaking, individual, and must rest upon its own merits; but the naval annals of Britain would have been very different from what they are, had a too calculating spirit of caution been prevalent in those whose deeds they record.

There is another point of view, in which the character of Blake, as a commander, exacts attention, and that owing to the very peculiar nature of the times, and the consequent object of the expeditions in which he was engaged. A general disposition prevailed, particularly on the part of maritime and commercial powers, to take advantage of the disorders in England; and in consequence, much spoliation and insult had been endured by English merchantmen. To this cause of irritation was subsequently added a manifest reluctance to act fairly towards the Commonwealth, unless when prompted by fear. On this account, Blake, especially in his later services, was frequently called upon to exercise a discretion in his negociations, which peculiarly evinced the spirit and character of the man. It is not to be denied that, in some instances, he displayed the overbearing features of the republicanism of antiquity, and, alive only to the honour of his own country, neglected the consideration which is due to the feelings and rights of others; but this was the prevailing spirit of all the leaders of the Commonwealth, and all men must be judged with an allowance for the predominant sentiment of the times. The sword-in-hand intercourse of the Admiral with the Courts of Spain and Portugal, the Duke of Tuscany, and others in the Mediterranean, more particularly illustrate the existence of the disposition here alluded to, as relates to specific

* Hist, of the Rebellion, vol. iii. p. 602.

national objects. The following characteristic anecdote, related by Bishop Burnet, exhibits a like spirit in reference to a minor point. Although a similar piece of conduct at present, would scarcely be deemed justifiable, it requires a strong exertion of reason to be altogether out of humour with it.

"While Blake lay in the road of Malaga, before the war broke out with Spain, some of his seamen, going ashore, met the Host carrying about, and not only paid no respect to it, but laughed at those who did. One of the Spanish priests put the people upon resenting this indignity, and they fell upon them and beat them severely. When they returned to their ships, they complained of this usage; upon which Blake sent a trumpet to the Viceroy to demand the priest, who was the chief instrument in that ill usage. The Viceroy answered, that he had no authority over the priests, and so could not dispose of them. General Blake, upon that, sent him word that he would not inquire who had the power to send the priest to him, but if he were not sent within three hours, he would burn their town. The Spaniards, hearing this, obliged the Viceroy to send the priest to Blake, and he justified himself upon the petulant behaviour of the seamen. Blake answered, that if he had sent a complaint to him of it, he would have punished them severely, since he would not suffer his men to affront the established religion of any place at which he touched; but he took it ill that he had set on the Spaniards to do it, 'for he would have him and the whole world to know, that none but an ENGLISHMAN should chastise an ENGLISHMAN.' He then treated the priest civilly and sent him back, being satisfied that he had him in his power. Cromwell was much delighted with this, and read the letter in council with great satisfaction, saying that he hoped he should make the name of an Englishman as great as ever that of a Roman* had been."†

Had a commander so distinguished as Blake, died within a century of the present time, materials would, most likely, have abounded for a very particular account of his deportment, manners, and conduct in private life; with all those various minor points of character which are so necessary to individualize a portrait, and render it exclusively that of the person whom it is intended to represent. In the time of Blake, there was no periodical press on the alert to diffuse all sorts of information respecting celebrated men; even to a fatiguing extreme. Quartos and octavos did not then appear within three months of the decease of any person of the least notoriety; which if crude and ill-digested as formal biography, at least form a collection of all the matter of fact and hearsay, known or in circulation, for the exercise of sounder judgment and more prudent consideration in after time. We however learn, that in person Admiral Blake was under the middle size; but that his features were prepossessing and manly, with a quick, lively, and intelligent eye. It has already been observed, that from his youth, he was distinguished by gravity, and simplicity of manners, occasionally enlivened by a humorous bluntness of speech. Some homely lines of Winstanley, in his 'English Worthies,' intimate, that he, who made so many men tremble, was himself peculiarly embarrassed and confused in the company of women; a fact which may account for his always remaining a bachelor. He was pious, without displaying any of the affectation and hypocrisy which mingled so much with the religious pretensions of the age, and which prevailed to an almost ludicrous excess among the party to which he was attached. Sincerity and the absence of everything bordering on intrigue, or dissimulation, were indeed the characteristics of Blake. He was liberal to the very extent of his fortune, and his purse was always open to his officers; he was strictly just and humane to every body; and to his sailors he proved himself a parent. This mixture of the amiable and softer qualities with the most fervent courage, invincible fortitude, and eminent talents, is not unprecedented, although rare. It is well for human nature that the union may exist; and to the honour at once of the individual, his profession, and the country which gave him birth, it has seldom been exhibited more conspicuously and more uniformly than in ADMIRAL ROBERT BLAKE. *

* Another proof of the classical tendency of the Republican spirit of that age.

† Burnet's Hist. of His Own Times, fol. edit. vol. i. p. 80, 81.

* The fortunes of the brothers of the Admiral are involved in some obscurity; but it is asserted by the author of 'Lives, English and Foreign,' that his brother Humphrey was so much harassed for his nonconformity, after the restoration, as to be induced to sell his estate and repair with his family to Carolina. A considerable family of the name certainly lived in that state; the head of which was one of the Lord Proprietors. Several descendants of the family are also to be found in the West of England.

DRINKWATER [afterwards] BETHUNE, John Elliott (9)

# LIFE OF GALILEO:

## WITH ILLUSTRATIONS OF THE ADVANCEMENT OF EXPERIMENTAL PHILOSOPHY.

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### Chapter I.

*Introduction.*

The knowledge which we at present possess of the phenomena of nature and of their connection has not by any means been regularly progressive, as we might have expected, from the time when they first drew the attention of mankind. Without entering into the question touching the scientific acquirements of eastern nations at a remote period, it is certain that some among the early Greeks were in possession of several truths, however acquired, connected with the economy of the universe, which were afterwards suffered to fall into neglect and oblivion. But the philosophers of the old school appear in general to have confined themselves at the best to observations; very few traces remain of their having instituted *experiments*, properly so called. This putting of nature to the torture, as Bacon calls it, has occasioned the principal part of modern philosophical discoveries. The experimentalist may so order his examination of nature as to vary at pleasure the circumstances in which it is made, often to discard accidents which complicate the general appearances, and at once to bring any theory which he may form to a decisive test. The province of the mere observer is necessarily limited: the power of selection among the phenomena to be presented is in great measure denied to him, and he may consider himself fortunate if they are such as to lead him readily to a knowledge of the laws which they follow.

Perhaps to this imperfection of method it may be attributed that natural philosophy continued to be stationary, or even to decline, during a long series of ages, until little more than two centuries ago. Within this comparatively short period it has rapidly reached a degree of perfection so different from its former degraded state, that we can hardly institute any comparison between the two. Before that epoch, a few insulated facts, such as might first happen to be noticed, often inaccurately observed and always too hastily generalized, were found sufficient to excite the naturalist's lively imagination; and having once pleased his fancy with the supposed fitness of his artificial scheme, his perverted ingenuity was thenceforward employed in forcing the observed phenomena into an imaginary agreement with the result of his theory; instead of taking the more rational, and it should seem, the more obvious, method of correcting the theory by the result of his observations, and considering the one merely as the general and abbreviated expression of the other. But natural phenomena were not then valued on their own account, and for the proofs which they afford of a vast and beneficent design in the structure of the universe, so much as for the fertile topics which the favourite mode of viewing the subject supplied to the spirit of scholastic disputation: and it is a humiliating reflection that mankind never reasoned so ill as when they most professed to cultivate the art of reasoning. However specious the objects, and alluring the announcements of this art, the then prevailing manner of studying it curbed and corrupted all that is free and noble in the human mind. Innumerable fallacies lurked every where among the most generally received opinions, and crowds of dogmatic and self-sufficient pedants fully justified the lively definition, that "logic is the art of talking unintelligibly on things of which we are ignorant."*

The error which lay at the root of the philosophy of the middle ages was this:—from the belief that general laws and universal principles might be discovered, of which the natural phenomena were *effects*, it was thought that the proper order of study was, first to detect the general *cause*, and then to pursue it into its consequences; it was considered absurd to begin with the effect instead of the cause; whereas the real choice lay between proceeding from particular facts

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* Ménage.

to general facts, or from general facts to particular facts; and it was under this misrepresentation of the real question that all the sophistry lurked. As soon as it is well understood that the general *cause* is no other than a single fact, common to a great number of phenomena, it is necessarily perceived that an accurate scrutiny of these latter must precede any safe reasoning with respect to the former. But at the time of which we are speaking, those who adopted this order of reasoning, and who began their inquiries by a minute and sedulous investigation of facts, were treated with disdain, as men who degraded the lofty name of philosophy by bestowing it upon mere mechanical operations. Among the earliest and noblest of these was Galileo.

It is common, especially in this country, to name Bacon as the founder of the present school of experimental philosophy; we speak of the Baconian or inductive method of reasoning as synonimous and convertible terms, and we are apt to overlook what Galileo had already done before Bacon's writings appeared. Certainly the Italian did not range over the circle of the sciences with the supreme and searching glance of the English philosopher, but we find in every part of his writings philosophical maxims which do not lose by comparison with those of Bacon; and Galileo deserves the additional praise, that he himself gave to the world a splendid practical illustration of the value of the principles which he constantly recommended. In support of this view of the comparative deserts of these two celebrated men, we are able to adduce the authority of Hume, who will be readily admitted as a competent judge of philosophical merit, where his prejudices cannot bias his decision. Discussing the character of Bacon, he says, " If we consider the variety of talents displayed by this man, as a public speaker, a man of business, a wit, a courtier, a companion, an author, a philosopher, he is justly the object of great admiration. If we consider him merely as an author and philosopher, the light in which we view him at present, though very estimable, he was yet inferior to his contemporary Galileo, perhaps even to Kepler. Bacon pointed out at a distance the road to true philosophy: Galileo both pointed it out to others, and made himself considerable advances in it. The Englishman was ignorant of geometry: the Florentine revived that science, excelled in it, and was the first that applied it, together with experiment, to natural philosophy. The former rejected with the most positive disdain the system of Copernicus: the latter fortified it with new proofs derived both from reason and the senses."*

If we compare them from another point of view, not so much in respect of their intrinsic merit, as of the influence which each exercised on the philosophy of his age, Galileo's superior talent or better fortune, in arresting the attention of his contemporaries, seems indisputable. The fate of the two writers is directly opposed the one to the other; Bacon's works seem to be most studied and appreciated when his readers have come to their perusal, imbued with knowledge and a philosophical spirit, which, however, they have attained independently of his assistance. The proud appeal to posterity which he uttered in his will, " For my name and memory, I leave it to men's charitable speeches, and to foreign nations, and the next ages," of itself indicates a consciousness of the fact that his contemporary countrymen were but slightly affected by his philosophical precepts. But Galileo's personal exertions changed the general character of philosophy in Italy: at the time of his death, his immediate pupils had obtained possession of the most celebrated universities, and were busily engaged in practising and enforcing the lessons which he had taught them; nor was it then easy to find there a single student of natural philosophy who did not readily ascribe the formation of his principles to the direct or remote influence of Galileo's example. Unlike Bacon's, his reputation, and the value of his writings, were higher among his contemporaries than they have since become. This judgment perhaps awards the highest intellectual prize to him whose disregarded services rise in estimation with the advance of knowledge; but the praise due to superior usefulness belongs to him who succeeded in training round him a school of imitators, and thereby enabled his imitators to surpass himself.

The biography of men who have devoted themselves to philosophical pursuits seldom affords so various and striking a succession of incidents as that

* Hume's England, James I.

of a soldier or statesman. The life of a man who is shut up during the greater part of his time in his study or laboratory supplies but scanty materials for personal details; and the lapse of time rapidly removes from us the opportunities of preserving such peculiarities as might have been worth recording. An account of it will therefore consist chiefly in a review of his works and opinions, and of the influence which he and they have exercised over his own and succeeding ages. Viewed in this light, few lives can be considered more interesting than that of Galileo; and if we compare the state in which he found, with that in which he left, the study of nature, we shall feel how justly an enthusiastic panegyric pronounced upon the age immediately following him may be transferred to this earlier period. "This is the age wherein all men's minds are in a kind of fermentation, and the spirit of wisdom and learning begins to mount and free itself from those drossie and terrene impediments wherewith it has been so long clogged, and from the insipid phlegm and *caput mortuum* of useless notions in which it hath endured so violent and long a fixation. This is the age wherein, methinks, philosophy comes in with a spring tide, and the peripatetics may as well hope to stop the current of the tide, or, with Xerxes, to fetter the ocean, as hinder the overflowing of free philosophy. Methinks I see how all the old rubbish must be thrown away, and the rotten buildings be overthrown and carried away, with so powerful an inundation. These are the days that must lay a new foundation of a more magnificent philosophy, never to be overthrown, that will empirically and sensibly canvass the phenomena of nature, deducing the causes of things from such originals in nature as we observe are producible by art, and the infallible demonstration of mechanics: and certainly this is the way, and no other, to build a true and permanent philosophy."*

## Chapter II.

*Galileo's Birth—Family—Education—Observation of the Pendulum—Pulsilogies — Hydrostatical Balance—Lecturer at Pisa.*

Galileo Galilei was born at Pisa, on the 15th day of February, 1564, of a noble and ancient Florentine family, which, in the middle of the fourteenth century, adopted this surname instead of Bonajuti, under which several of their ancestors filled distinguished offices in the Florentine state. Some misapprehension has occasionally existed, in consequence of the identity of his proper name with that of his family; his most correct appellation would perhaps be Galileo de' Galilei, but the surname usually occurs as we have written it. He is most commonly spoken of by his Christian name, agreeably to the Italian custom; just as Sanzio, Buonarotti, Sarpi, Reni, Vecelli, are universally known by their Christian names of Raphael, Michel Angelo, Fra Paolo, Guido, and Titian.

Several authors have followed Rossi in styling Galileo illegitimate, but without having any probable grounds even when they wrote, and the assertion has since been completely disproved by an inspection of the registers at Pisa and Florence, in which are preserved the dates of his birth, and of his mother's marriage, eighteen months previous to it.*

His father, Vincenzo Galilei, was a man of considerable talent and learning, with a competent knowledge of mathematics, and particularly devoted to the theory and practice of music, on which he published several esteemed treatises. The only one which it is at present easy to procure—his Dialogue on ancient and modern music—exhibits proofs, not only of a thorough acquaintance with his subject, but of a sound and vigorous understanding applied to other topics incidentally discussed. There is a passage in the introductory part, which becomes interesting when considered as affording some traces of the precepts by which Galileo was in all probability trained to reach his preeminent station in the intellectual world. "It appears to me," says one of the speakers in the dialogue, "that they who in proof of any assertion rely simply on the weight of authority, without adducing any argument in support of it, act very absurdly: I, on the contrary, wish to be allowed freely to question and freely to answer you without any sort of adulation, as well becomes those who are truly in search of truth." Sentiments like these were of rare occurrence at the close of the sixteenth century, and it is

* Power's Experimental Philosophy, 1663.

* Erythræus, Pinacotheca, vol. i.; Salusbury's Life of Galileo. Nelli, Vita di Gal. Galilei.

to be regretted that Vincenzo hardly lived long enough to witness his idea of a true philosopher splendidly realized in the person of his son. Vincenzo died at an advanced age, in 1591. His family consisted of three sons, Galileo, Michel Angelo, and Benedetto, and the same number of daughters, Giulia, Virginia, and Livia. After Vincenzo's death the chief support of the family devolved upon Galileo, who seems to have assisted them to his utmost power. In a letter to his mother, dated 1600, relative to the intended marriage of his sister Livia with a certain Pompeo Baldi, he agrees to the match, but recommends its temporary postponement, as he was at that time exerting himself to furnish money to his brother Michel Angelo, who had received the offer of an advantageous settlement in Poland. As the sum advanced to his brother, which prevented him from promoting his sister's marriage, did not exceed 200 crowns, it may be inferred that the family were in a somewhat straitened condition. However he promises, as soon as his brother should repay him, "to take measures for the young lady, since she too is bent upon *coming out* to prove the miseries of this world."—As Livia was at the date of this letter in a convent, the last expression seems to denote that she had been destined to take the veil. This proposed marriage never took place, but Livia was afterwards married to Taddeo Galletti: her sister Virginia married Benedetto Landucci. Galileo mentions one of his sisters, (without naming her) as living with him in 1619 at Bellosguardo. Michel Angelo is probably the same brother of Galileo who is mentioned by Liceti as having communicated from Germany some observations on natural history.* He finally settled in the service of the Elector of Bavaria; in what situation is not known, but upon his death the Elector granted a pension to his family, who then took up their abode at Munich. On the taking of that city in 1636, in the course of the bloody thirty years' war, which was then raging between the Austrians and Swedes, his widow and four of his children were killed, and every thing which they possessed was either burnt or carried away. Galileo sent for his two nephews, Alberto and a younger brother, to Arcetri near Florence, where he was then living. These two were then the only survivors of Michel Angelo's family; and many of Galileo's letters about that date contain allusions to the assistance he had been affording them. The last trace of Alberto is on his return into Germany to the Elector, in whose service his father had died. These details include almost every thing which is known of the rest of Vincenzo's family.

Galileo exhibited early symptoms of an active and intelligent mind, and distinguished himself in his childhood by his skill in the construction of ingenious toys and models of machinery, supplying the deficiencies of his information from the resources of his own invention; and he conciliated the universal good-will of his companions by the ready good nature with which he employed himself in their service and for their amusement. It is worthy of observation, that the boyhood of his great follower Newton, whose genius in many respects so closely resembled his own, was marked by a similar talent. Galileo's father was not opulent, as has been already stated: he was burdened with a large family, and was unable to provide expensive instructors for his son; but Galileo's own energetic industry rapidly supplied the want of better opportunities; and he acquired, under considerable disadvantages, the ordinary rudiments of a classical education, and a competent knowledge of the other branches of literature which were then usually studied. His leisure hours were applied to music and drawing; for the former accomplishment he inherited his father's talent, being an excellent performer on several instruments, especially on the lute; this continued to be a favourite recreation during the whole of his life. He was also passionately fond of painting, and at one time he wished to make it his profession: and his skill and judgment of pictures were highly esteemed by the most eminent contemporary artists, who did not scruple to own publicly their deference to young Galileo's criticism.

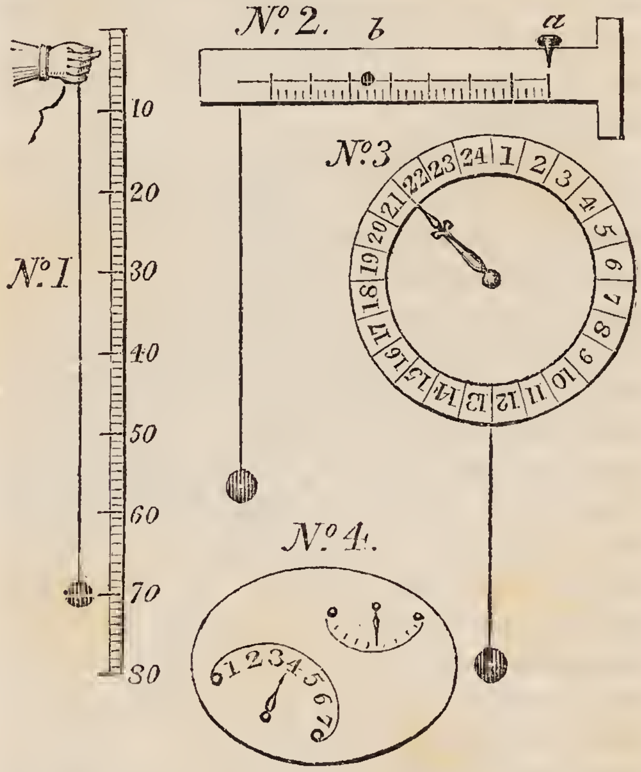
When he had reached his nineteenth year, his father, becoming daily more sensible of his superior genius, determined, although at a great personal sacrifice, to give him the advantages of an university education. Accordingly, in 1581, he commenced his academical studies in the university of his native town, Pisa, his father at this time intending that

* De his quæ diu vivunt. Patavii, 1612.

he should adopt the profession of medicine. In the matriculation lists at Pisa, he is styled Galileo, the son of Vincenzo Galilei, a Florentine, Scholar in Arts. It is dated 5th November, 1581. Viviani, his pupil, friend, and panegyrist, declares that, almost from the first day of his being enrolled on the lists of the academy, he was noticed for the reluctance with which he listened to the dogmas of the Aristotelian philosophy, then universally taught; and he soon became obnoxious to the professors from the boldness with which he promulgated what they styled his philosophical paradoxes. His early habits of free inquiry were irreconcileable with the mental quietude of his instructors, whose philosophic doubts, when they ventured to entertain any, were speedily lulled by a quotation from Aristotle. Galileo thought himself capable of giving the world an example of a sounder and more original mode of thinking; he felt himself destined to be the founder of a new school of rational and experimental philosophy. Of this we are now securely enjoying the benefits; and it is difficult at this time fully to appreciate the obstacles which then presented themselves to free inquiry: but we shall see, in the course of this narrative, how arduous their struggle was who happily effected this important revolution. The vindictive rancour with which the partisans of the old philosophy never ceased to assail Galileo is of itself a sufficient proof of the prominent station which he occupied in the contest.

Galileo's earliest mechanical discovery, to the superficial observer apparently an unimportant one, occurred during the period of his studies at Pisa. His attention was one day arrested by the vibrations of a lamp swinging from the roof of the cathedral, which, whether great or small, seemed to recur at equal intervals. The instruments then employed for measuring time were very imperfect: Galileo attempted to bring his observation to the test before quitting the church, by comparing the vibrations with the beatings of his own pulse, and his mind being then principally employed upon his intended profession, it occurred to him, when he had further satisfied himself of their regularity by repeated and varied experiments, that the process he at first adopted might be reversed, and that an instrument on this principle might be usefully employed in ascertaining the rate of the pulse, and its variation from day to day. He immediately carried the idea into execution, and it was for this sole and limited purpose that the first pendulum was constructed. Viviani tells us, that the value of the invention was rapidly appreciated by the physicians of the day, and was in common use in 1654, when he wrote.

Santorio, who was professor of medicine at Padua, has given representations of four different forms of these




instruments, which he calls pulsilogies, (*pulsilogias,*) and strongly recommends to medical practitioners.* These instruments seem to have been used in the following manner: No. 1 consists merely of a weight fastened to a string and a graduated scale. The string being gathered up into the hand till the vibrations of the weight coincided with the beatings of the patient's pulse, the length was ascertained from the scale, which, of course, if great, indicated a languid, if shorter, a more lively action. In No. 2 the improvement is introduced of connecting the scale and string, the length of the latter is regulated by the turns of a peg at *a*, and a bead upon the string at *b* showed the measure. No. 3 is still more compact, the string being shortened by winding upon an axle at the back of the dial-plate. The construction of No. 4, which Santorio claims as his own improvement, is not given, but it is probable that the principal index, by its motion, shifted a weight to different distances from the point of suspension, and that the period of vibration

* Comment. in Avicennam. Venetiis, 1625.

was still more accurately adjusted by a smaller weight connected with the second index. Venturi seems to have mistaken the third figure for that of a pendulum clock, as he mentions this as one of the earliest adaptations of Galileo's principle to that purpose* ; but it is obvious, from Santorio's description, that it is nothing more than a circular scale, the index showing, by the figure to which it points, the length of string remaining unwound upon the axis. We shall, for the present, postpone the consideration of the invention of pendulum clocks, and the examination of the different claims to the honour of their first construction.

At the time of which we are speaking, Galileo was entirely ignorant of mathematics, the study of which was then at a low ebb, not only in Italy, but in every part of Europe. Commandine had recently revived a taste for the writings of Euclid and Archimedes, and Vieta Tartalea and others had made considerable progress in algebra, Guido Ubaldi and Benedetti had done something towards establishing the principles of statics, which was the only part of mechanics as yet cultivated; but with these inconsiderable exceptions the application of mathematics to the phenomena of nature was scarcely thought of. Galileo's first inducement to acquire a knowledge of geometry arose from his partiality for drawing and music, and from the wish to understand their principles and theory. His father, fearful lest he should relax his medical studies, refused openly to encourage him in this new pursuit ; but he connived at the instruction which his son now began to receive in the writings of Euclid, from the tuition of an intimate friend, named Ostilio Ricci, who was one of the professors in the university. Galileo's whole attention was soon directed to the enjoyment of the new sensations thus communicated to him, insomuch that Vincenzo, finding his prognostics verified, began to repent his indirect sanction, and privately requested Ricci to invent some excuse for discontinuing his lessons. But it was fortunately too late ; the impression was made and could not be effaced ; from that time Hippocrates and Galen lay unheeded before the young physician, and served only to conceal from his father's sight the mathematical volumes on which the whole of his time was really employed. His progress soon revealed the true nature of his pursuits : Vincenzo yielded to the irresistible predilection of his son's mind, and no longer attempted to turn him from the speculations to which his whole existence was thenceforward abandoned.

After mastering the elementary writers, Galileo proceeded to the study of Archimedes, and, whilst perusing the Hydrostatics of that author, composed his earliest work,—an Essay on the Hydrostatical Balance. In this he explains the method probably adopted by Archimedes for the solution of Hiero's celebrated question*, and shows himself already well acquainted with the true principles of specific gravities. This essay had an immediate and important influence on young Galileo's fortunes, for it introduced him to the approving notice of Guido Ubaldi, then one of the most distinguished mathematicians of Italy. At his suggestion Galileo applied himself to consider the position of the centre of gravity in solid bodies, a choice of subject that sufficiently showed the estimate Ubaldi had formed of his talents; for it was a question on which Commandine had recently written, and which engaged at that time the attention of geometricians of the highest order. Galileo tells us himself that he discontinued these researches on meeting with Lucas Valerio's treatise on the same subject. Ubaldi was so much struck with the genius displayed in the essay with which Galileo furnished him, that he introduced him to his brother, the Cardinal Del Monte: by this latter he was mentioned to Ferdinand de' Medici, the reigning Duke of Tuscany, as a young man of whom the highest expectations might be entertained. By the Duke's patronage he was nominated, in 1589, to the lectureship of mathematics at Pisa, being then in his twenty-sixth year. His public salary was fixed at the insignificant sum of sixty crowns annually, but he had an opportunity of greatly adding to his income by private tuition.

## Chapter III.

*Galileo at Pisa—Aristotle—Leonardo da Vinci—Galileo becomes a Copernican—Urstisius—Bruno—Experiments on falling bodies—Galileo at Padua—Thermometer.*

No sooner was Galileo settled in his new office than he renewed his inquiries into the phenomena of nature with increased diligence. He instituted a course

* Essai sur les Ouvrages de Leonard da Vinci. Paris, 1797.

* See Treatise on Hydrostatics.

of experiments for the purpose of putting to the test the mechanical doctrines of Aristotle, most of which he found unsupported even by the pretence of experience. It is to be regretted that we do not more frequently find detailed his method of experimenting, than occasionally in the course of his dialogues, and it is chiefly upon the references which he makes to the results with which the experiments furnished him, and upon the avowed and notorious character of his philosophy, that the truth of these accounts must be made to depend. Venturi has found several unpublished papers by Galileo on the subject of motion, in the Grand Duke's private library at Florence, bearing the date of 1590, in which are many of the theorems which he afterwards developed in his Dialogues on Motion. These were not published till fifty years afterwards, and we shall reserve an account of their contents till we reach that period of his life.

Galileo was by no means the first who had ventured to call in question the authority of Aristotle in matters of science, although he was undoubtedly the first whose opinions and writings produced a very marked and general effect. Nizzoli, a celebrated scholar who lived in the early part of the 16th century, had condemned Aristotle's philosophy, especially his Physics, in very unequivocal and forcible terms, declaring that, although there were many excellent truths in his writings, the number was scarcely less of false, useless, and ridiculous propositions*. About the time of Galileo's birth, Benedetti had written expressly in confutation of several propositions contained in Aristotle's mechanics, and had expounded in a clear manner some of the doctrines of statical equilibrium.† Within the last forty years it has been established that the celebrated painter Leonardo da Vinci, who died in 1519, amused his leisure hours in scientific pursuits; and many ideas appear to have occurred to him which are to be found in the writings of Galileo at a later date. It is not impossible (though there are probably no means of directly ascertaining the fact) that Galileo may have been acquainted with Leonardo's investigations, although they remained, till very lately, almost unknown to the mathematical world. This supposition is rendered more probable from the fact, that Mazenta, the preserver of Leonardo's manuscripts, was, at the very time of their discovery, a contemporary student with Galileo at Pisa. Kopernik, or, as he is usually called, Copernicus, a native of Thorn in Prussia, had published his great work, De Revolutionibus, in 1543, restoring the knowledge of the true theory of the solar system, and his opinions were gradually and silently gaining ground.

It is not satisfactorily ascertained at what period Galileo embraced the new astronomical theory. Gerard Voss attributes his conversion to a public lecture of Mæstlin, the instructor of Kepler; and later writers (among whom is Laplace) repeat the same story, but without referring to any additional sources of information, and in most instances merely transcribing Voss's words, so as to shew indisputably whence they derived their account. Voss himself gives no authority, and his general inaccuracy makes his mere word not of much weight. The assertion appears, on many accounts, destitute of much probability. If the story were correct, it seems likely that some degree of acquaintance, if not of friendly intercourse, would have subsisted between Mæstlin, and his supposed pupil, such as in fact we find subsisting between Mæstlin and his acknowledged pupil Kepler, the devoted friend of Galileo; but, on the contrary, we find Mæstlin writing to Kepler himself of Galileo as an entire stranger, and in the most disparaging terms. If Mæstlin could lay claim to the honour of so celebrated a disciple, it is not likely that he could fail so entirely to comprehend the distinction it must confer upon himself as to attempt diminishing it by underrating his pupil's reputation. There is a passage in Galileo's works which more directly controverts the claim advanced for Mæstlin, although Salusbury, in his life of Galileo, having apparently an imperfect recollection of its tenor, refers to this very passage in confirmation of Voss's statement. In the second part of the dialogue on the Copernican system, Galileo makes Sagredo, one of the speakers in it, give the following account:—"Being very young, and having scarcely finished my course of philosophy, which I left off as being set upon other employments, there chanced to come into these parts a certain foreigner of Rostoch, *whose name, as I remember, was Christianus Urstisius*, a follower of Copernicus, who, in an academy, gave two or three lectures upon this point, to whom many flocked as auditors; but I, thinking they went

* Antibarbarus Philosophicus. Francofurti, 1674.
† Speculationum liber. Venetiis, 1585.

more for the novelty of the subject than otherwise, did not go to hear him; for I had concluded with myself that that opinion could be no other than a solemn madness; and questioning some of those who had been there, I perceived they all made a jest thereof, except one, who told me that the business was not altogether to be laughed at: and because the man was reputed by me to be very intelligent and wary, I repented that I was not there, and began from that time forward, as oft as I met with any one of the Copernican persuasion, to demand of them if they had been always of the same judgment. Of as many as I examined I found not so much as one who told me not that he had been a long time of the contrary opinion, but to have changed it for this, as convinced by the strength of the reasons proving the same; and afterwards questioning them one by one, to see whether they were well possessed of the reasons of the other side, I found them all to be very ready and perfect in them, so that I could not truly say that they took this opinion out of ignorance, vanity, or to show the acuteness of their wits. On the contrary, of as many of the Peripatetics and Ptolemeans as I have asked, (and out of curiosity I have talked with many,) what pains they had taken in the book of Copernicus, I found very few that had so much as superficially perused it, but of those who I thought had understood the same, not one: and, moreover, I have inquired amongst the followers of the Peripatetic doctrine, if ever any of them had held the contrary opinion, and likewise found none that had. Whereupon, considering that there was no man who followed the opinion of Copernicus that had not been first on the contrary side, and that was not very well acquainted with the reasons of Aristotle and Ptolemy, and, on the contrary, that there was not one of the followers of Ptolemy that had ever been of the judgment of Copernicus, and had left that to embrace this of Aristotle;—considering, I say, these things, I began to think that one who leaveth an opinion imbued with his milk and followed by very many, to take up another, owned by very few, and denied by all the schools, and that really seems a great paradox, must needs have been moved, not to say forced, by more powerful reasons. For this cause I am become very curious to dive, as they say, into the bottom of this business." It seems improbable that Galileo should think it worth while to give so detailed an account of the birth and growth of opinion in any one besides himself; and although Sagredo is not the personage who generally in the dialogue represents Galileo, yet as the real Sagredo was a young nobleman, a pupil of Galileo himself, the account cannot refer to him. The circumstance mentioned of the intermission of his philosophical studies, though in itself trivial, agrees very well with Galileo's original medical destination. Urstisius is not a fictitious name, as possibly Salusbury may have thought, when alluding to this passage; he was mathematical professor at Bâle, about 1567, and several treatises by him are still extant. In 1568 Voss informs us that he published some new questions on Purbach's Theory of the Planets. He died at Bâle in 1588, when Galileo was about twenty-two years old.

It is not unlikely that Galileo also, in part, owed his emancipation from popular prejudices to the writings of Giordano Bruno, an unfortunate man, whose unsparing boldness in exposing fallacies and absurdities was rewarded by a judicial murder, and by the character of heretic and infidel, with which his executioners endeavoured to stigmatize him for the purpose of covering over their own atrocious crime. Bruno was burnt at Rome in 1600, but not, as Montucla supposes, on account of his "Spaccio della Bestia trionfante." The title of this book has led him to suppose that it was directed against the church of Rome, to which it does not in the slightest degree relate. Bruno attacked the fashionable philosophy alternately with reason and ridicule, and numerous passages in his writings, tedious and obscure as they generally are, show that he had completely outstripped the age in which he lived. Among his astronomical opinions, he believed that the universe consisted of innumerable systems of suns with assemblages of planets revolving round each of them, like our own earth, the smallness of which, alone, prevented their being observed by us. He remarked further, "that it is by no means improbable that there are yet other planets revolving round our own sun, which we have not yet noticed, either on account of their minute size or too remote distance from us." He declined asserting that all the apparently fixed stars are really so, considering this as not sufficiently proved, "because at such enormous distances the motions become difficult to estimate, and it is only by

long observation that we can determine if any of these move round each other, or what other motions they may have." He ridiculed the Aristotelians in no very measured terms—"They harden themselves, and heat themselves, and embroil themselves for Aristotle; they call themselves his champions, they hate all but Aristotle's friends, they are ready to live and die for Aristotle, and yet they do not understand so much as the titles of Aristotle's chapters." And in another place he introduces an Aristotelian inquiring, "Do you take Plato for an ignoramus—Aristotle for an ass?" to whom he answers, "My son, I neither call them asses, nor you mules,—them baboons, nor you apes,—as you would have me: I told you that I esteem them the heroes of the world, but I will not credit them without sufficient reason; and if you were not both blind and deaf, you would understand that I must disbelieve their absurd and contradictory assertions."* Bruno's works, though in general considered those of a visionary and madman, were in very extensive circulation, probably not the less eagerly sought after from being included among the books prohibited by the Romish church; and although it has been reserved for later observations to furnish complete verification of his most daring speculations, yet there was enough, abstractedly taken, in the wild freedom of his remarks, to attract a mind like Galileo's; and it is with more satisfaction that we refer the formation of his opinions to a man of undoubted though eccentric genius, like Bruno, than to such as Maestlin, who, though a diligent and careful observer, seems seldom to have taken any very enlarged views of the science on which he was engaged.

With a few exceptions similar to those above mentioned, the rest of Galileo's contemporaries well deserved the contemptuous epithet which he fixed on them of Paper Philosophers, for, to use his own words, in a letter to Kepler on this subject, "this sort of men fancied philosophy was to be studied like the Æneid or Odyssey, and that the true reading of nature was to be detected by the collation of texts." Galileo's own method of philosophizing was widely different; seldom omitting to bring with every new assertion the test of experiment, either directly in confirmation of it, or tending to show its probability and consistency. We have already seen that he engaged in a series of experiments to investigate the truth of some of Aristotle's positions. As fast as he succeeded in demonstrating the falsehood of any of them, he denounced them from his professorial chair with an energy and success which irritated more and more against him the other members of the academic body.

There seems something in the stubborn opposition which he encountered in establishing the truth of his mechanical theorems, still more stupidly absurd than in the ill will to which, at a later period of his life, his astronomical opinions exposed him: it is intelligible that the vulgar should withhold their assent from one who pretended to discoveries in the remote heavens, which few possessed instruments to verify, or talents to appreciate; but it is difficult to find terms for stigmatizing the obdurate folly of those who preferred the evidence of their books to that of their senses, in judging of phenomena so obvious as those, for instance, presented by the fall of bodies to the ground. Aristotle had asserted, that if two different weights of the same material were let fall from the same height, the heavier one would reach the ground sooner than the other, in the proportion of their weights. The experiment is certainly not a very difficult one, but nobody thought of that method of argument, and consequently this assertion had been long received, upon his word, among the axioms of the science of motion. Galileo ventured to appeal from the authority of Aristotle to that of his own senses, and maintained that, with the exception of an inconsiderable difference, which he attributed to the disproportionate resistance of the air, they would fall in the same time. The Aristotelians ridiculed and refused to listen to such an idea. Galileo repeated his experiments in their presence from the famous leaning tower at Pisa: and with the sound of the simultaneously falling weights still ringing in their ears, they could persist in gravely maintaining that a weight of ten pounds would reach the ground in a tenth part of the time taken by one of a single pound, because they were able to quote chapter and verse in which Aristotle assures them that such is the fact. A temper of mind like this could not fail to produce ill will towards him who felt no scruples in exposing their wilful folly; and the watchful malice of these men soon found the means of making Galileo desirous of quitting

* De l'Infinito Universo. Dial. 3. La Çena de le Cenere, 1584.

his situation at Pisa. Don Giovanni de' Medici, a natural son of Cosmo, who possessed a slight knowledge of mechanics on which he prided himself, had proposed a contrivance for cleansing the port of Leghorn, on the efficiency of which Galileo was consulted. His opinion was unfavourable, and the violence of the inventor's disappointment, (for Galileo's judgment was verified by the result,) took the somewhat unreasonable direction of hatred towards the man whose penetration had foreseen the failure. Galileo's situation was rendered so unpleasant by the machinations of this person, that he decided on accepting overtures elsewhere, which had already been made to him; accordingly, under the negotiation of his staunch friend Guido Ubaldi, and with the consent of Ferdinand, he procured from the republic of Venice a nomination for six years to the professorship of mathematics in the university of Padua, whither he removed in September 1592.

Galileo's predecessor in the mathematical chair at Padua was Moleti, who died in 1588, and the situation had remained unfilled during the intervening four years. This seems to show that the directors attributed but little importance to the knowledge which it was the professor's duty to impart. This inference is strengthened by the fact, that the amount of the annual salary attached to it did not exceed 180 florins, whilst the professors of philosophy and civil law, in the same university, were rated at the annual stipends of 1400 and 1680 florins.* Galileo joined the university about a year after its triumph over the Jesuits, who had established a school in Padua about the year 1542, and, increasing yearly in influence, had shown symptoms of a design to get the whole management of the public education into the hands of their own body.† After several violent disputes it was at length decreed by the Venetian senate, in 1591, that no Jesuit should be allowed to give instruction at Padua in any of the sciences professed in the university. It does not appear that after this decree they were again troublesome to the university, but this first decree against them was followed, in 1606, by a second more peremptory, which banished them entirely from the Venetian territory. Galileo would of course find his fellow-professors much embittered against that society, and would naturally feel inclined to make common cause with them, so that it is not unlikely that the hatred which the Jesuits afterwards bore to Galileo on personal considerations, might be enforced by their recollection of the university to which he had belonged.

Galileo's writings now began to follow each other with great rapidity, but he was at this time apparently so careless of his reputation, that many of his works and inventions, after a long circulation in manuscript among his pupils and friends, found their way into the hands of those who were not ashamed to publish them as their own, and to denounce Galileo's claim to the authorship as the pretence of an impudent plagiarist. He was, however, so much beloved and esteemed by his friends, that they vied with each other in resenting affronts of this nature offered to him, and in more than one instance he was relieved, by their full and triumphant answers, from the trouble of vindicating his own character.

To this epoch of Galileo's life may be referred his re-invention of the thermometer. The original idea of this useful instrument belongs to the Greek mathematician Hero; and Santorio himself, who has been named as the inventor by Italian writers, and at one time claimed it himself, refers it to him. In 1638, Castelli wrote to Cesarini that "he remembered an experiment shown to him more than thirty-five years back by Galileo, who took a small glass bottle, about the size of a hen's egg, the neck of which was twenty-two inches long, and as narrow as a straw. Having well heated the bulb in his hands, and then introducing its mouth into a vessel in which was a little water, and withdrawing the heat of his hand from the bulb, the water rose in the neck of the bottle more than eleven inches above the level in the vessel, and Galileo employed this principle in the construction of an instrument for measuring heat and cold."* In 1613, a Venetian nobleman named Sagredo, who has been already mentioned as Galileo's friend and pupil, writes to him in the following words: "I have brought the instrument which you invented for measuring heat into several convenient and perfect forms, so that the difference of temperature between two rooms is seen as far as 100 de-

* Riccoboni, Commentarii de Gymnasio Patavino, 1598.

† Nelli.

* Nelli.

grees."* This date is anterior to the claims both of Santorio and Drebbel, a Dutch physician, who was the first to introduce it into Holland.

Galileo's thermometer, as we have just seen, consisted merely of a glass tube ending in a bulb, the air in which, being partly expelled by heat, was replaced by water from a glass into which the open end of the tube was plunged, and the different degrees of temperature were indicated by the expansion of the air which yet remained in the bulb, so that the scale would be the reverse of that of the thermometer now in use, for the water would stand at the highest level in the coldest weather. It was, in truth, a barometer also, in consequence of the communication between the tube and external air, although Galileo did not intend it for this purpose, and when he attempted to determine the relative weight of the air, employed a contrivance still more imperfect than this rude barometer would have been. A passage among his posthumous fragments intimates that he subsequently used spirit of wine instead of water.

Viviani attributes an improvement of this imperfect instrument, but without specifying its nature, to Ferdinand II., a pupil and subsequent patron of Galileo, and, after the death of his father Cosmo, reigning duke of Florence. It was still further improved by Ferdinand's younger brother, Leopold de' Medici, who invented the modern process of expelling all the air from the tube by boiling the spirit of wine in it, and of hermetically sealing the end of the tube, whilst the contained liquid is in this expanded state, which deprived it of its barometrical character, and first made it an accurate thermometer. The final improvement was the employment of mercury instead of spirit of wine, which is recommended by Lana so early as 1670, on account of its equable expansion.† For further details on the history and use of this instrument, the reader may consult the Treatises on the Thermometer and Pyrometer.

## Chapter IV.

*Astronomy before Copernicus—Fracastoro — Bacon — Kepler — Galileo's Treatise on the Sphere.*

This period of Galileo's lectureship at Padua derives interest from its including the first notice which we find of his having embraced the doctrines of the Copernican astronomy. Most of our readers are aware of the principles of the theory of the celestial motions which Copernicus restored; but the number of those who possess much knowledge of the cumbrous and unwieldy system which it superseded is perhaps more limited. The present is not a fit opportunity to enter into many details respecting it; these will find their proper place in the History of Astronomy: but a brief sketch of its leading principles is necessary to render what follows intelligible.

The earth was supposed to be immoveably fixed in the centre of the universe, and immediately surrounding it the atmospheres of air and fire, beyond which the sun, moon, and planets, were thought to be carried round the earth, fixed each to a separate orb or heaven of solid but transparent matter. The order of distance in which they were supposed to be placed with regard to the central earth was as follows: The Moon, Mercury, Venus, The Sun, Mars, Jupiter, and Saturn. It became a question in the ages immediately preceding Copernicus, whether the Sun was not nearer the Earth than Mercury, or at least than Venus; and this question was one on which the astronomical theorists were then chiefly divided.

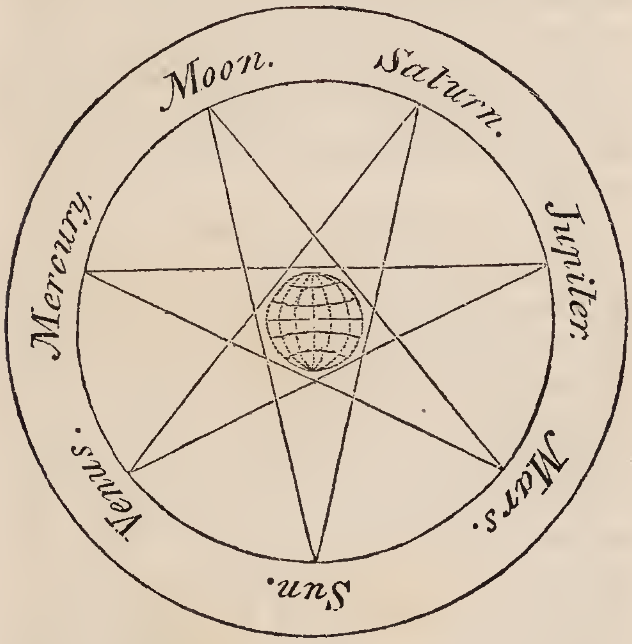
We possess at this time a curious record of a former belief in this arrangement of the Sun and planets, in the order in which the days of the week have been named from them. According to the dreams of Astrology, each planet was supposed to exert its influence in succession, reckoning from the most distant down to the nearest, over each hour of the twenty-four. The planet which was supposed to predominate over the first hour, gave its name to that day.* The general reader will trace this curious fact more easily with the French or Latin names than with the English, which have been translated into the titles of the corresponding Saxon deities. Placing the Sun and planets in the following order, and beginning, for instance, with Monday, or the Moon's day; Saturn ruled the second hour of that day, Jupiter the third, and so round till we come again and again to the Moon on the 8th, 15th, and 22d hours; Saturn ruled the 23d,

* Venturi. Memorie e Lettere di Gal. Galilei. Modena, 1821.

† Prodromo all' Arte Maestra. Brescia, 1670.

* Dion Cassius, lib. 37.

Jupiter the 24th, so that the next day would be the day of Mars, or, as the Saxons translated it, Tuisco's day, or Tuesday. In the same manner the following days would belong respectively to Mercury or Woden, Jupiter or Thor, Venus or Frea, Saturn or Seater, the Sun, and again the Moon. In this manner the whole week will be found to complete the cycle of the seven planets.




The other stars were supposed to be fixed in an outer orb, beyond which were two crystalline spheres, (as they were called,) and on the outside of all, the *primum mobile* or *first moveable*, which sphere was supposed to revolve round the earth in twenty-four hours, and by its friction, or rather, as most of the philosophers of that day chose to term it, by the sort of heavenly influence which it exercised on the interior orbs, to carry them round with a similar motion. Hence the diversity of day and night. But beside this principal and general motion, each orb was supposed to have one of its own, which was intended to account for the apparent changes of position of the planets with respect to the fixed stars and to each other. This supposition, however, proving insufficient to account for all the irregularities of motion observed, two hypotheses were introduced.—First, that to each planet belonged several concentric spheres or heavens, casing each other like the coats of an onion, and, secondly, that the centres of these solid spheres, with which the planet revolved, were placed in the circumference of a secondary revolving sphere, the centre of which secondary sphere was situated at the earth. They thus acquired the names of Eccentrics or Epicycles, the latter word signifying a circle upon a circle. The whole art of astronomers was then directed towards inventing and combining different eccentric and epicyclical motions, so as to represent with tolerable fidelity the ever varying phenomena of the heavens. Aristotle had lent his powerful assistance in this, as in other branches of natural philosophy, in enabling the false system to prevail against and obliterate the knowledge of the true, which, as we gather from his own writings, was maintained by some philosophers before his time. Of these ancient opinions, only a few traces now remain, principally preserved in the works of those who were adverse to them. Archimedes says expressly that Aristarchus of Samos, who lived about 300 B. C., taught the immobility of the sun and stars, and that the earth is carried round the central sun.* Aristotle's words are: " Most of those who assert that the whole concave is finite, say that the earth is situated in the middle point of the universe: those who are called Pythagoreans, who live in Italy, are of a contrary opinion. For they say that fire is in the centre, and that the earth, which, according to them, is one of the stars, occasions the change of day and night by its own motion, with which it is carried about the centre." It might be doubtful, upon this passage alone, whether the Pythagorean theory embraced more than the diurnal motion of the earth, but a little farther, we find the following passage: " Some, as we have said, make the earth to be one of the stars: others say that it is placed in the centre of the Universe, and revolves on a central axis."† From

* The pretended translation by Roberval of an Arabic version of Aristarchus, " De Systemate Mundi," in which the Copernican system is fully developed, is spurious. Menage asserts this in his observations on Diogen. Laert. lib. 8, sec. 85, tom. ii., p. 389. (Ed. Amst. 1692.) The commentary contains many authorities well worth consulting. Delambre, Histoire de l'Astronomie, infers it from its not containing some opinions which Archimedes tells us were held by Aristarchus. A more direct proof may be gathered from the following blunder of the supposed translator. Astronomers had been long aware that the earth in different parts of her orbit is at different distances from the sun. Roberval wished to claim for Aristarchus the credit of having known this, and introduced into his book, not only the mention of the fact, but an explanation of its cause. Accordingly he makes Aristarchus give a reason " why the sun's apogee (or place of greatest distance from the earth) must always be at the north summer solstice." In fact, it was there, or nearly so, in Roberval's time, and he knew not but that it had always been there. It is however moveable, and, when Aristarchus lived, was nearly half way between the solstices and equinoxes. He therefore would hardly have given a reason for the necessity of a phenomenon of which, if he observed anything on the subject, he must have observed the contrary. The change in the obliquity of the earth's axis to the ecliptic was known in the time of Roberval, and he accordingly has introduced the proper value which it had in Aristarchus's time.

† De Cœlo. lib. 2.

which, in conjunction with the former extract, it very plainly appears that the Pythagoreans maintained both the diurnal and annual motions of the earth.

Some idea of the supererogatory labour entailed upon astronomers by the adoption of the system which places the earth in the centre, may be formed in a popular manner by observing, in passing through a thickly planted wood, in how complicated a manner the relative positions of the trees appear at each step to be continually changing, and by considering the difficulty with which the laws of their apparent motions could be traced, if we were to attempt to refer these changes to a real motion of the trees instead of the traveller. The apparent complexity in the heavens is still greater than in the case suggested; because, in addition to the earth's motions, with which all the stars appear to be impressed, each of the planets has also a real motion of its own, which of course greatly contributes to perplex and complicate the general appearances. Accordingly the heavens rapidly became, under this system,

> "With centric and eccentric scribbled o'er,
> Cycle and epicycle, orb in orb;"*

crossing and penetrating each other in every direction. Maestlin has given a concise enumeration of the principal orbs which belonged to this theory. After warning the readers that "they are not mere fictions which have nothing to correspond with them out of the imagination, but that they exist really, and bodily in the heavens,"† he describes seven principal spheres belonging to each planet, which he classes as Eccentrics, Epicycles, and Concentrepicycles, and explains their use in accounting for the planet's revolutions, motions of the apogee, and nodes, &c. &c. In what manner this multitude of solid and crystalline orbs were secured from injuring or interfering with each other was not very closely inquired into.

The reader will cease to expect any very intelligible explanation of this and numberless other difficulties which belong to this unwieldy machinery when he is introduced to the reasoning by which it was upheld. Gerolamo Fracastoro, who lived in the sixteenth century, writes in the following terms, in his work entitled Homocentrica, (certainly one of the best productions of the day,) in which he endeavours to simplify the necessary apparatus, and to explain all the phenomena (as the title of his book implies) by concentric spheres round the earth. "There are some, not only of the ancients but also among the moderns, who believe that the stars move freely without any such agency; but it is difficult to conceive in what manner they have imbued themselves with this notion, *since not only reason, but the very senses, inform us that all the stars are carried round fastened to solid spheres.*" What ideas Fracastoro entertained of the evidence of the "senses" it is not now easy to guess, but he goes on to give a specimen of the "reasoning" which appeared to him so incontrovertible. "The planets are observed to move one while forwards, then backwards, now to the right, now to the left, quicker and slower by turns; which variety is consistent with a compound structure like that of an animal, which possesses in itself various springs and principles of action, but is totally at variance with our notion of a simple and undecaying substance like the heavens and heavenly bodies. For that which is simple, is altogether single, and singleness is of one only nature, and one nature can be the cause of only one effect; and therefore it is altogether impossible that the stars of themselves should move with such variety of motion. And besides, if the stars move by themselves, they either move in an empty space, or in a fluid medium like the air. But there cannot be such a thing as empty space, and if there were such a medium, the motion of the star would occasion condensation and rarefaction in different parts of it, which is the property of corruptible bodies and where they exist some violent motion is going on; but the heavens are incorruptible and are not susceptible of violent motion, and hence, and from many other similar reasons, any one who is not obstinate may satisfy himself that the stars cannot have any independent motion."

Some persons may perhaps think that arguments of this force are unnecessarily dragged from the obscurity to which they are now for the most part happily consigned; but it is essential, in order to set Galileo's character and merits in their true light, to show how low at this

* Paradise Lost, b. viii. v. 83.

† Itaque tam circulos primi motus quam orbes secundorum mobilium reverâ in cœlesti corpore esse concludimus, &c. Non ergo sunt mera figmenta, quibus extra mentem nihil correspondeat. M. Maestlini, De Astronomiæ Hypothesibus disputatio. Heidelbergæ, 1582.

time philosophy had fallen. For we shall form a very inadequate notion of his powers and deserts if we do not contemplate him in the midst of men who, though of undoubted talent and ingenuity, could so far bewilder themselves as to mistake such a string of unmeaning phrases for argument: we must reflect on the difficulty every one experiences in delivering himself from the erroneous impressions of infancy, which will remain stamped upon the imagination in spite of all the efforts of matured reason to erase them, and consider every step of Galileo's course as a triumph over difficulties of a like nature. We ought to be fully penetrated with this feeling before we sit down to the perusal of his works, every line of which will then increase our admiration of the penetrating acuteness of his invention and unswerving accuracy of his judgment. In almost every page we discover an allusion to some new experiment, or the germ of some new theory; and amid all this wonderful fertility it is rarely indeed that we find the exuberance of his imagination seducing him from the rigid path of philosophical induction. This is the more remarkable as he was surrounded by friends and contemporaries of a different temperament and much less cautious disposition. A disadvantageous contrast is occasionally furnished even by the sagacious Bacon, who could so far deviate from the sound principles of inductive philosophy, as to write, for instance, in the following strain, bordering upon the worst manner of the Aristotelians :—" Motion in a circle has no limit, and seems to emanate from the appetite of the body, which moves only for the sake of moving, and that it may follow itself and seek its own embraces, and put in action and enjoy its own nature, and exercise its peculiar operation: on the contrary, motion in a straight line seems transitory, and to move towards a limit of cessation or rest, and that it may reach some point, and then put off its motion."* Bacon rejected all the machinery of the *primum mobile* and the solid spheres, the eccentrics and the epicycles, and carried his dislike of these doctrines so far as to assert that nothing short of their gross absurdity could have driven theorists to the extravagant supposition of the motion of the earth, which, said he, " we know to be most false."* Instances of extravagant suppositions and premature generalizations are to be found in almost every page of his other great contemporary, Kepler.

It is with pain that we observe Delambre taking every opportunity, in his admirable History of Astronomy, to undervalue and sneer at Galileo, seemingly for the sake of elevating the character of Kepler, who appears his principal favourite, but whose merit as a philosopher cannot safely be brought into competition with that of his illustrious contemporary. Delambre is especially dissatisfied with Galileo, for taking no notice, in his " System of the World," of the celebrated laws of the planetary motions which Kepler discovered, and which are now inseparably connected with his name. The analysis of Newton and his successors has now identified those apparently mysterious laws with the general phenomena of motion, and has thus entitled them to an attention of which, before that time, they were scarcely worthy; at any rate not more than is at present the empirical law which includes the distances of all the planets from the sun (roughly taken) in one algebraical formula. The observations of Kepler's day were scarcely accurate enough to prove that the relations which he discovered between the distances of the planets from the sun and the periods of their revolutions around him were necessarily to be received as demonstrated truths; and Galileo surely acted most prudently and philosophically in holding himself altogether aloof from Kepler's fanciful devices and numeral concinnities, although, with all the extravagance, they possessed much of the genius of the Platonic reveries, and although it did happen that Galileo, by systematically avoiding them, failed to recognise some important truths. Galileo probably was thinking of those very laws, when he said of Kepler, " He possesses a bold and free genius, perhaps too much so; but his mode of philosophizing is widely different from mine." We shall have further occasion in the sequel to recognise the justice of this remark.

In the treatise on the Sphere which bears Galileo's name, and which, if he be indeed the author of it, was composed during the early part of his residence at

* Opuscula Philosophica, Thema Cœli.

* "Nobis constat falsissimum esse." De Aug. Scient. lib. iii. c. 3. 1623.

Padua, he also adopts the Ptolemaic system, placing the earth immoveable in the centre, and adducing against its motion the usual arguments, which in his subsequent writings he ridicules and refutes. Some doubts have been expressed of its authenticity; but, however this may be, we have it under Galileo's own hand that he taught the Ptolemaic system, in compliance with popular prejudices, for some time after he had privately become a convert to the contrary opinions. In a letter, apparently the first which he wrote to Kepler, dated from Padua, 1597, he says, acknowledging the receipt of Kepler's Mysterium Cosmographicum, "I have as yet read nothing beyond the preface of your book, from which however I catch a glimpse of your meaning, and feel great joy on meeting with so powerful an associate in the pursuit of truth, and consequently such a friend to truth itself, for it is deplorable that there should be so few who care about truth, and who do not persist in their perverse mode of philosophizing; but as this is not the fit time for lamenting the melancholy condition of our times, but for congratulating you on your elegant discoveries in confirmation of the truth, I shall only add a promise to peruse your book dispassionately, and with a conviction that I shall find in it much to admire. *This I shall do the more willingly because many years ago I became a convert to the opinions of Copernicus*,* and by that theory have succeeded in fully explaining many phenomena, which on the contrary hypothesis are altogether inexplicable. I have arranged many arguments and confutations of the opposite opinions, *which however I have not yet dared to publish*, fearing the fate of our master Copernicus, who, although he has earned immortal fame among a few, yet by an infinite number (for so only can the number of fools be measured) is exploded and derided. If there were many such as you, I would venture to publish my speculations; but, since that is not so, I shall take time to consider of it." This interesting letter was the beginning of the friendship of these two great men, which lasted uninterruptedly till 1632, the date of Kepler's death. That extraordinary genius never omitted an opportunity of testifying his admiration of Galileo, although there were not wanting persons envious of their good understanding, who exerted themselves to provoke coolness and quarrel between them. Thus Brutius writes to Kepler in 1602*: "Galileo tells me he has written to you, and has got your book, which however he denied to Magini, and I abused him for praising you with too many qualifications. I know it to be a fact that, both in his lectures, and elsewhere, he is publishing your inventions as his own; but I have taken care, and shall continue to do so, that all this shall redound not to his credit but to yours." The only notice which Kepler took of these repeated insinuations, which appear to have been utterly groundless, was, by renewed expressions of respect and admiration, to testify the value he set upon his friend and fellow-labourer in philosophy.

## Chapter V.

*Galileo re-elected Professor at Padua—New star—Compass of proportion—Capra—Gilbert—Proposals to return to Pisa—Lost writings—Cavalieri.*

Galileo's reputation was now rapidly increasing: his lectures were attended by many persons of the highest rank; among whom were the Archduke Ferdinand, afterwards Emperor of Germany, the Landgrave of Hesse, and the Princes of Alsace and Mantua. On the expiration of the first period for which he had been elected professor, he was rechosen for a similar period, with a salary increased to 320 florins. The immediate occasion of this augmentation is said by Fabroni†, to have arisen out of the malice of an ill wisher of Galileo, who, hoping to do him disservice, apprized the senate that he was not married to Marina Gamba, then living with him, and the mother of his son Vincenzo. Whether or not the senate might consider themselves entitled to inquire into the morality of his private life, it was probably from a wish to mark their sense of the informer's impertinence, that they returned the brief answer, that "if he had a family to provide for, he stood the more in need of an increased stipend."

During Galileo's residence at Padua, and, according to Viviani's intimation, towards the thirtieth year of his age, that is to say in 1594, he experienced

* Id autum eò libentius faciam, quod in Copernici sententiam multis abhinc annis venerim.—Kepl. Epistolæ.

* Kepleri Epistolæ.

† Vitæ Italorum Illustrium.

the first attack of a disease which pressed heavily on him for the rest of his life. He enjoyed, when a young man, a healthy and vigorous constitution, but chancing to sleep one afternoon near an open window, through which was blowing a current of air cooled artificially by the fall of water, the consequences were most disastrous to him. He contracted a sort of chronic complaint, which showed itself in acute pains in his limbs, chest, and back, accompanied with frequent hæmorrhages and loss of sleep and appetite; and this painful disorder thenceforward never left him entirely, but recurred intermittingly, with greater or less violence, as long as he lived. Others of the party did not even escape so well, but died shortly after committing this imprudence.

In 1604, the attention of astronomers was called to the contemplation of a new star, which appeared suddenly with great splendour in the constellation Serpentarius, or Ophiuchus, as it is now more commonly called. Maestlin, who was one of the earliest to notice it, relates his observations in the following words: "How wonderful is this new star! I am certain that I did not see it before the 29th of September, nor indeed, on account of several cloudy nights, had I a good view till the 6th of October. Now that it is on the other side of the sun, instead of surpassing Jupiter as it did, and almost rivalling Venus, it scarcely matches the Cor Leonis, and hardly surpasses Saturn. It continues however to shine with the same bright and strongly sparkling light, and changes its colours almost with every moment; first tawny, then yellow, presently purple and red, and, when it has risen above the vapours, most frequently white." This was by no means an unprecedented phenomenon; and the curious reader may find in Riccioli* a catalogue of the principal new stars which have at different times appeared. There is a tradition of a similar occurrence as early as the times of the Greek astronomer Hipparchus, who is said to have been stimulated by it to the formation of his catalogue of the stars; and only thirty-two years before, in 1572, the same remarkable phenomenon in the constellation Cassiopeia was mainly instrumental in detaching the celebrated Tycho Brahe from the chemical studies, which till then divided his attention with astronomy. Tycho's star disappeared at the end of two years; and at that time Galileo was a child. On the present occasion, he set himself earnestly to consider the new phenomenon, and embodied the results of his observations in three lectures, which have been unfortunately lost. Only the exordium of the first has been preserved: in this he reproaches his auditors with their general insensibility to the magnificent wonders of creation daily exposed to their view, in no respect less admirable than the new prodigy, to hear an explanation of which they had hurried in crowds to his lecture room. He showed, from the absence of parallax, that the new star could not be, as the vulgar hypothesis represented, a mere meteor engendered in our atmosphere and nearer the earth than the moon, but must be situated among the most remote heavenly bodies. This was inconceivable to the Aristotelians, whose notions of a perfect, simple, and unchangeable sky were quite at variance with the introduction of any such new body; and we may perhaps consider these lectures as the first public declaration of Galileo's hostility to the old Ptolemaic and Aristotelian astronomy.

In 1606 he was reappointed to the lectureship, and his salary a second time increased, being raised to 520 florins. His public lectures were at this period so much thronged that the ordinary place of meeting was found insufficient to contain his auditors, and he was on several occasions obliged to adjourn to the open air,—even from the school of medicine, which was calculated to contain one thousand persons.

About this time he was considerably annoyed by a young Milanese, of the name of Balthasar Capra, who pirated an instrument which Galileo had invented some years before, and had called the geometrical and military compass. The original offender was a German named Simon Mayer, whom we shall meet with afterwards arrogating to himself the merit of one of Galileo's astronomical discoveries; but on this occasion, as soon as he found Galileo disposed to resent the injury done to him, he hastily quitted Italy, leaving his friend Capra to bear alone the shame of the exposure which followed. The instrument is of simple construction, consisting merely of two straight rulers, connected by a joint; so that they can be set to any required angle. This simple and useful instrument, now called the Sector, is to be found in almost every

* Almagestum Novum, vol. i.

case of mathematical instruments. Instead of the trigonometrical and logarithmic lines which are now generally engraved upon it, Galileo's compass merely contained, on one side, three pairs of lines, divided in simple, duplicate, and triplicate proportion, with a fourth pair on which were registered the specific gravities of several of the most common metals. These were used for multiplications, divisions, and the extraction of roots; for finding the dimensions of equally heavy balls of different materials, &c. On the other side were lines contrived for assisting to describe any required polygon on a given line; for finding polygons of one kind equal in area to those of another; and a multitude of other similar operations useful to the practical engineer.

Unless the instrument, which is now called Gunter's scale, be much altered from what it originally was, it is difficult to understand on what grounds Salusbury charges Gunter with plagiarism from Galileo's Compass. He declares that he has closely compared the two, and can find no difference between them.* There has also been some confusion, by several writers, between this instrument and what is now commonly called the Proportional Compass. The latter consists of two slips of metal pointed at each end, and connected by a pin which, sliding in a groove through both, can be shifted to different positions. Its use is to find proportional lines; for it is obvious that the openings measured by each pair of legs will be in the same proportion in which the slips are divided by the centre. The divisions usually marked on it are calculated for finding the submultiples of straight lines, and the chords of submultiple arcs. Montucla has mentioned this mistake of one instrument for the other, and charges Voltaire with the more inexcusable error of confounding Galileo's with the Mariner's Compass. He refers to a treatise by Hulsius for his authority in attributing the Proportional Compass to Burg, a German astronomer of some celebrity. Horcher also has been styled the inventor; but he did no more than describe its form and application. In the frontispiece of his book is an engraving of this compass exactly similar to those which are now used.† To the description which Galileo published of his compass, he added a short treatise on the method of measuring heights and distances with the quadrant and plumb line. The treatise, which is printed by itself at the end of the first volume of the Padua edition of Galileo's works, contains nothing more than the demonstrations belonging to the same operations. They are quite elementary, and contain little or nothing that was new even at that time.

Such an instrument as Galileo's Compass was of much more importance before the grand discovery of logarithms than it can now be considered: however it acquires an additional interest from the value which he himself set on it. In 1607, Capra, at the instigation of Mayer, published as his own invention what he calls the proportional hoop, which is a mere copy of Galileo's instrument. This produced from Galileo a long essay, entitled "A Defence of Galileo against the Calumnies and Impostures of Balthasar Capra." His principal complaint seems to have been of the misrepresentations which Capra had published of his lectures on the new star already mentioned, but he takes occasion, after pointing out the blunders and falsehoods which Capra had committed on that occasion, to add a complete proof of his piracy of the geometrical compass. He showed, from the authenticated depositions of workmen, and of those for whom the instruments had been fabricated, that he had devised them as early as the year 1597, and had explained their construction and use both to Balthasar himself and to his father Aurelio Capra, who was then residing in Padua. He gives, in the same essay, the minutes of a public meeting between himself and Capra, in which he proved, to the satisfaction of the university, that wherever Capra had endeavoured to introduce into his book propositions which were not to be met with in Galileo's, he had fallen into the greatest absurdities, and betrayed the most complete ignorance of his subject. The consequence of this public exposure, and of the report of the famous Fra Paolo Sarpi, to whom the matter had been referred, was a formal prohibition by the university of Capra's publication, and all copies of the book then on hand were seized, and probably destroyed, though Galileo has preserved it from oblivion by incorporating it in his own publication.

Nearly at the same time, 1607, or immediately after, he first turned his attention towards the loadstone, on which our

* Math. Coll. vol. ii.

† Constructio Circini Proportionum. Moguntiæ, 1605.

countryman Gilbert had already published his researches, conducted in the true spirit of the inductive method. Very little that is original is to be found in Galileo's works on this subject, except some allusions to his method of arming magnets, in which, as in most of his practical and mechanical operations, he appears to have been singularly successful. Sir Kenelm Digby* asserts, that the magnets armed by Galileo would support twice as great a weight as one of Gilbert's of the same size. Galileo was well acquainted, as appears from his frequent allusions in different parts of his works, with what Gilbert had done, of whom he says, " I extremely praise, admire, and envy this author ;—I think him, moreover, worthy of the greatest praise for the many new and true observations that he has made to the disgrace of so many vain and fabling authors, who write, not from their own knowledge only, but repeat every thing they hear from the foolish vulgar, without attempting to satisfy themselves of the same by experience, perhaps that they may not diminish the size of their books."

Galileo's reputation being now greatly increased, proposals were made to him, in 1609, to return to his original situation at Pisa. He had been in the habit of passing over to Florence during the academic vacation, for the purpose of giving mathematical instruction to the younger members of Ferdinand's family; and Cosmo, who had now succeeded his father as duke of Tuscany, regretted that so masterly a genius had been allowed to leave the university which he naturally should have graced. A few extracts from Galileo's answers to these overtures will serve to show the nature of his situation at Padua, and the manner in which his time was there occupied. " I will not hesitate to say, having now laboured during twenty years, and those the best of my life, in dealing out, as one may say, in detail, at the request of any body, the little talent which God has granted to my assiduity in my profession, that my wish certainly would be to have sufficient rest and leisure to enable me, before my life comes to its close, to conclude three great works which I have in hand, and to publish them ; which might perhaps bring some credit to me, and to those who had favoured me in this undertaking, and possibly may be of greater and more frequent service to students than in the rest of my life I could personally afford them. Greater leisure than I have here I doubt if I could meet with elsewhere, so long as I am compelled to support my family from my public and private lectures, (nor would I willingly lecture in any other city than this, for several reasons which would be long to mention) nevertheless not even the liberty I have here is sufficient, where I am obliged to spend many, and often the best hours of the day at the request of this and that man.—My public salary here is 520 florins, which I am almost certain will be advanced to as many crowns upon my re-election, and these I can greatly increase by receiving pupils, and from private lectures, to any extent that I please. My public duty does not confine me during more than 60 half hours in the year, and even that not so strictly but that I may, on occasion of any business, contrive to get some vacant days ; the rest of my time is absolutely at my own disposal; but because my private lectures and domestic pupils are a great hindrance and interruption of my studies, I wish to live entirely exempt from the former, and in great measure from the latter : for if I am to return to my native country, I should wish the first object of his Serene Highness to be, that leisure and opportunity should be given me to complete my works without employing myself in lecturing.—And, in short, I should wish to gain my bread from my writings, which I would always dedicate to my Serene Master.—The works which I have to finish are principally —two books on the system or structure of the Universe, an immense work, full of philosophy, astronomy, and geometry ; three books on Local Motion, a science entirely new, no one, either ancient or modern, having discovered any of the very many admirable accidents which I demonstrate in natural and violent motions, so that I may with very great reason call it a new science, and invented by me from its very first principles ; three books of Mechanics, two on the demonstration of principles and one of problems ; and although others have treated this same matter, yet all that has been hitherto written, neither in quantity, nor otherwise, is the quarter of what I am writing on it. I have also different treatises on natural subjects; On sound and speech; On light and colours ; On the tide; On the composition of continuous quantity ; On the

* Treatise of the Nature of Bodies, London, 1665.

motions of animals;—And others besides. I have also an idea of writing some books relating to the military art, giving not only a model of a soldier, but teaching with very exact rules every thing which it is his duty to know that depends upon mathematics; as the knowledge of castrametation, drawing up battalions, fortifications, assaults, planning, surveying, the knowledge of artillery, the use of instruments, &c. I also wish to reprint the 'Use of my Geometrical Compass,' which is dedicated to his highness, and which is no longer to be met with; for this instrument has experienced such favour from the public, that in fact no other instruments of this kind are now made, and I know that up to this time several thousands of mine have been made.—I say nothing as to the amount of my salary, feeling convinced that as I am to live upon it, the graciousness of his highness would not deprive me of any of those comforts, which, however, I feel the want of less than many others; and therefore I say nothing more on the subject. Finally, on the title and profession of my service, I should wish that to the name of Mathematician, his highness would add that of Philosopher, as I profess to have studied a greater number of years in philosophy than months in pure mathematics; and how I have profited by it, and if I can or ought to deserve this title, I may let their highnesses see as often as it shall please them to give me an opportunity of discussing such subjects in their presence with those who are most esteemed in this knowledge." It may perhaps be seen in the expressions of this letter, that Galileo was not inclined to undervalue his own merits, but the peculiar nature of the correspondence should be taken into account, which might justify his indulging a little more than usual in self-praise, and it would have been perhaps almost impossible for him to have remained entirely blind to his vast superiority over his contemporaries.

Many of the treatises which Galileo here mentions, as well as another on dialling, have been irrecoverably lost, through the superstitious weakness of some of his relations, who after his death suffered the family confessor to examine his papers, and to destroy whatever seemed to him objectionable; a portion which, according to the notions then prevalent, was like to comprise the most valuable part of the papers submitted to this expurgation. It is also supposed that many were burnt by his infatuated grandson Cosimo, who conceived he was thus offering a proper and pious sacrifice before devoting himself to the life of a missionary. A Treatise on Fortification, by Galileo, was found in 1793, and is contained among the documents published by Venturi. Galileo does not profess in it to give much original matter, but to lay before his readers a compendium of the most approved principles then already known. It has been supposed that Gustavus Adolphus of Sweden attended Galileo's lectures on this subject, whilst in Italy; but the fact is not satisfactorily ascertained. Galileo himself mentions a Prince Gustavus of Sweden to whom he gave instruction in mathematics, but the dates cannot well be made to agree. The question deserves notice only from its having been made the subject of controversy.

The loss of Galileo's Essay on Continuous Quantity is particularly to be regretted, as it would be highly interesting to see how far he succeeded in methodizing his thoughts on this important topic. It is to his pupil Cavalieri (who refused to publish his book so long as he hoped to see Galileo's printed) that we owe "The Method of Indivisibles," which is universally recognized as one of the first germs of the powerful methods of modern analysis. Throughout Galileo's works we find many indications of his having thought much on the subject, but his remarks are vague, and bear little, if at all, on the application of the method. To this the chief part of Cavalieri's book is devoted, though he was not so entirely regardless of the principles on which his method of measuring spaces is founded, as he is sometimes represented. This method consisted in considering lines as made up of an infinite number of points, surfaces in like manner as composed of lines, and solids of surfaces; but there is an observation at the beginning of the 7th book, which shews clearly that Cavalieri had taken a much more profound view of the subject than is implied in this superficial exposition, and had approached very closely to the apparently more exact theories of his successors. Anticipating the objections to his hypothesis, he argues, that "there is no necessity to suppose the continuous quantities made up of these indivisible parts, *but only that they will observe the same ratios as those parts do.*" It ought not to be omitted, that Kepler also had given an impulse to

Cavalieri in his "New method of Guaging," which is the earliest work with which we are acquainted, where principles of this sort are employed.*

## Chapter VI.

*Invention of the telescope—Fracastoro—Porta—Reflecting telescope—Roger Bacon—Digges—De Dominis—Jansen—Lipperhey—Galileo constructs telescopes—Microscopes—Re-elected Professor at Padua for life.*

The year 1609 was signalized by Galileo's discovery of the telescope, which, in the minds of many, is the principal, if not the sole invention associated with his name. It cannot be denied that his fame, as the founder of the school of experimental philosophy, has been in an unmerited degree cast into the shade by the splendour of his astronomical discoveries; yet Lagrange† surely errs in the opposite extreme, when he almost denies that these form any real or solid part of the glory of this great man; and Montucla‡ omits an important ingredient in his merit, when he (in other respects very justly) remarks, that it required far less genius to point a telescope towards the heavens than to trace the unheeded, because daily recurring, phenomena of motion up to its simple and primary laws. We are to remember that in the days of Galileo a telescope could scarcely be pointed to the heavens with impunity, and that a courageous mind was required to contradict, and a strong one to bear down, a party, who, when invited to look on any object in the heavens which Aristotle had never suspected, immediately refused all credit to those senses, to which, on other occasions, they so confidently appealed. It surely is a real and solid part of Galileo's glory that he consumed his life in laborious and indefatigable observations, and that he persevered in announcing his discoveries undisgusted by the invectives, and undismayed by the persecutions, to which they subjected him. Plagiarist! liar! impostor! heretic! were among the expressions of malignant hatred lavished upon him, and although he also was not without some violent and foul-mouthed partisans, yet it must be told to his credit that he himself seldom condescended to notice these torrents of abuse, otherwise than by good-humoured retorts, and by prosecuting his observations with renewed assiduity and zeal.

The use of single lenses in aid of the sight had been long known. Spectacles were in common use at the beginning of the fourteenth century, and there are several hints, more or less obscure, in many early writers, of the effects which might be expected from a combination of glasses; but it does not appear with certainty that any of these authors had attempted to reduce their ideas to practice. After the discovery of the telescope, almost every country endeavoured to find in the writings of its early philosophers traces of the knowledge of such an instrument, but in general with success very inadeqnate to the zeal of their national prepossessions. There are two authors especially to whom the attention of Kepler and others was turned, immediately upon the promulgation of the discovery, as containing the germ of it in their works. These are Baptista Porta, and Gerolamo Fracastoro. We have already had occasion to quote the Homocentrica of Fracastoro, who died in 1553; the following expressions, though they seem to refer to actual experiment, yet fall short of the meaning with which it has been attempted to invest them. After explaining and commenting on some phenomena of refraction through different media, to which he was led by the necessity of reconciling his theory with the variable magnitudes of the planets, he goes on to say—"For which reason, those things which are seen at the bottom of water, appear greater than those which are at the top; and if any one look through two eyeglasses, *one placed upon the other*, he will see every thing much larger and nearer."* It should seem that this passage (as Delambre has already remarked) rather refers to the close application of one glass upon another, and it may fairly be doubted whether any thing analogous to the composition of the telescope was in the writer's thoughts. Baptista Porta writes on the same subject more fully;—"Concave lenses show distant objects most clearly, convex those which are nearer, whence they may be used to assist the sight. With a concave glass distant objects will be seen, small, but distinct; with a convex one those near at hand, larger, but confused; *if you*

* Nova Stereometria Doliorum—Lincii, 1615.
† Mecanique Analytique.
‡ Histoire des Mathématiques, tom. ii.

* "Per duo specilla ocularia si quis perspiciat, altero alteri superposito, majora multo et propinquiora videbit omnia."—Fracast. Homocentrica, § 2, c. 8.

*know rightly how to combine one of each sort, you will see both far and near objects larger and clearer.*"* These words show, if Porta really was then unacquainted with the telescope, how close it is possible to pass by an invention without lighting on it, for of precisely such a combination of a convex and concave lens, fitted to the ends of an organ pipe by way of tube, did the whole of Galileo's telescope consist. If Porta had stopped here he might more securely have enjoyed the reputation of the invention, but he then professes to describe the construction of his instrument, which has no relation whatever to his previous remarks. "I shall now endeavour to show in what manner we may contrive to recognize our friends at the distance of several miles, and how those of weak sight may read the most minute letters from a distance. It is an invention of great utility, and grounded on optical principles, nor is it at all difficult of execution; but it must be so divulged as not to be understood by the vulgar, and yet be clear to the sharpsighted." The description which follows seems far enough removed from the apprehended danger of being too clear, and indeed every writer who has hitherto quoted it has merely given the passage in its original Latin, apparently despairing of an intelligible translation. With some alterations in the punctuation, which appear necessary to bring it into any grammatical construction,† it may be supposed to bear something like the following meaning:—"Let a view be contrived in the centre of a mirror, where it is most effective. All the solar rays are exceedingly dispersed, and do not in the least come together (in the true centre); but there is a concourse of all the rays in the central part of the said mirror, half way towards the other centre, where the cross diameters meet. This view is contrived in the following manner. A concave cylindrical mirror placed directly in front, but with its axis inclined, must be adapted to that focus: and let obtuse angled or right angled triangles be cut out with two cross lines on each side drawn from the centre, and a glass (*specillum*) will be completed fit for the purposes we mentioned." If it were not for the word "*specillum*," which, in the passage immediately preceding this, Porta* contrasts with "*speculum*," and which he afterwards explains to mean a glass lens, it would be very clear that the foregoing passage (supposing it to have any meaning) must be referred to a reflecting telescope, and it is a little singular that while this obscure passage has attracted universal attention, no one, so far as we are aware, has taken any notice of the following unequivocal description of the principal part of Newton's construction of the same instrument. It is in the 5th chapter of the 17th book, where Porta explains by what device exceedingly minute letters may be read without difficulty. "Place a concave mirror so that the back of it may lie against your breast; opposite to it, and within the burning point, place the writing; put a plane mirror behind it, that may be under your eyes. Then the images of the letters which are in the concave mirror, and which the concave has magnified, will be reflected in the plane mirror, so that you may read without difficulty."

We have not been able to meet with the Italian translation of Porta's Natural Magic, which was published in 1611, under his own superintendence; but the English translator of 1658 would probably have known if any intelligible interpretation were there given of the mysterious passage above quoted, and his translation is so devoid of meaning as strongly to militate against this idea. Porta, indeed, claimed the invention as his own, and is believed to have hastened his death, (which happened in 1615, he being then 80 years old,) by the fatigue of composing a Treatise on the Telescope, in which he had promised to exhaust the subject. We do not know whether this is the same work which was published after his death by Stelliola,† but which contains no allusion to Porta's claim, and possibly Stelliola may have thought it most for his friend's reputation to suppress it. Schott‡ says, a friend of his had

* Si utrumque recte componere noveris, et longinqua et proxima majora et clara videbis.—Mag. Nat. lib. 17.

† The passage in the original, which is printed alike in the editions of 1598, 1607, 1619, and 1650, is as follows: Visus constituatur centro valentissimus speculi, ubi fiet, et valentissimè universales solares radii disperguntur, et coeunt minimè, sed centro prædicti speculi in illius medio, ubi diametri transversales, omnium ibi concursus. Constituitur hoc modo speculum concavum columnare æquidistantibus lateribus, sed lateri uno obliquo sectionibus illis accomodetur, trianguli vero obtusianguli, vel orthogonii secentur, hinc inde duobus transversalibus lineis, ex centro eductis. Et confectum erit specillum, ad id, quod diximus, utile.

* Diximus de Ptolemæi *speculo*, sive *specillo* potius, quo per sexcentena millia pervenientes naves conspiciebat.

† Il Telescopio, 1627.

‡ Magia Naturæ et Artis Herbipoli, 1657.

seen Porta's book in manuscript, and that it did at that time contain the assertion of Porta's title to the invention. After all it is not improbable that he may have derived his notions of magnifying distant objects from our celebrated countryman Roger Bacon, who died about the year 1300. He has been supposed, not without good grounds, to have been one of the first who recognised the use of single lenses in producing distinct vision, and he has some expressions with respect to their combination which promise effects analogous to those held out by Porta. In "The Admirable Force of Art and Nature," he says, "Physical figurations are far more strange, for in such manner may we frame perspects and looking-glasses that one thing shall appear to be many, as one man shall seeme a whole armie; and divers sunnes and moones, yea, as many as we please, shall appeare at one time, &c. And so may the perspects be framed, that things most farre off may seeme most nigh unto us, and clean contrarie, soe that we may reade very small letters an incredible distance from us, and behold things how little soever they be, and make stars to appeare wheresoever we will, &c. And, besides all these, we may so frame perspects that any man entering into a house he shall indeed see gold, and silver, and precious stones, and what else he will, but when he maketh haste to the place he shall find just nothing." It seems plain, that the author is here speaking solely of mirrors, and we must not too hastily draw the conclusion, because in the first and last of these assertions he is, to a certain extent, borne out by facts, that he therefore was in possession of a method of accomplishing the middle problem also. In the previous chapter, he gives a long list of notable things, (much in the style of the Marquis of Worcester's Century of Inventions) which if we can really persuade ourselves that he was capable of accomplishing, we must allow the present age to be still immeasurably inferior to him in science.

Thomas Digges, in the preface to his Pantometria, (published in 1591) declares, "My father, by his continuall painfull practises, assisted with demonstrations mathematicall, was able, and sundry times hath by proportionall glasses, duely situate in convenient angles, not only discouered things farre off, read letters, numbered peeces of money, with the verye coyne and superscription thereof, cast by some of his freends of purpose, upon downes in open fields; but also, seuen miles off, declared what hath beene doone at that instant in priuate places. He hath also sundrie times, by the sunne beames, fired powder and dischargde ordnance halfe a mile and more distante; which things I am the boulder to report, for that there are yet living diverse (of these his dooings) occulati testes, (eye witnesses) and many other matters farre more strange and rare, which I omit as impertinent to this place."

We find another pretender to the honour of the discovery of the telescope in the celebrated Antonio de Dominis, Archbishop of Spalatro, famous in the annals of optics for being one of the first to explain the theory of the rainbow. Montucla, following P. Boscovich, has scarcely done justice to De Dominis, whom he treats as a mere pretender and ignorant person. The indisposition of Boscovich towards him is sufficiently accounted for by the circumstance of his being a Catholic prelate who had embraced the cause of Protestantism. His nominal reconciliation with the Church of Rome would probably not have saved him from the stake, had not a natural death released him when imprisoned on that account at Rome. Judgment was pronounced upon him notwithstanding, and his body and books were publicly burnt in the Campo de' Fiori, in 1624. His treatise, De Radiis, (which is very rarely to be met with) was published by Bartolo after the acknowledged invention of the telescope by Galileo; but Bartolo tells us, in the preface, that the manuscript was communicated to him from a collection of papers written 20 years before, on his inquiring the Archbishop's opinion with respect to the newly discovered instrument, and that he got leave to publish it, "with the addition of one or two chapters." The treatise contains a complete description of a telescope, which, however, is professed merely to be an improvement on spectacles, and if the author's intention had been to interpolate an afterwritten account, in order to secure to himself the undeserved honour of the invention, it seems improbable that he would have suffered an acknowledgment of additions, previous to publication, to be inserted in the preface. Besides, the whole tone of the work is that of a candid and truth-seeking philosopher, very far indeed removed from being, as Mon-

tucla calls him, conspicuous for ignorance even among the ignorant men of his age. He gives a drawing of a convex and concave lens, and traces the passage of the rays through them; to which he subjoins, that he has not satisfied himself with any determination of the precise distance to which the glasses should be separated, according to their convexity and concavity, but recommends the proper distance to be found by actual experiment, and tells us, that the effect of the instrument will be to prevent the confusion arising from the interference of the direct and refracted rays, and to magnify the object by increasing the visible angle under which it is viewed. These, among the many claimants, are certainly the authors who approached the most nearly to the discovery: and the reader may judge, from the passages cited, whether the knowledge of the telescope can with probability be referred to a period earlier than the commencement of the 17th century. At all events, we can find no earlier trace of its being applied to any practical use; the knowlege, if it existed, remained speculative and barren.

In 1609, Galileo, then being on a visit to a friend at Venice, heard a rumour of the recent invention, by a Dutch spectacle-maker, of an instrument which was said to represent distant objects nearer than they usually appeared. According to his own account, this general rumour, which was confirmed to him by letters from Paris, was all that he learned on the subject; and returning to Padua, he immediately applied himself to consider the means by which such an effect could be produced. Fuccarius, in an abusive letter which he wrote on the subject, asserts that one of the Dutch telescopes had been at that time actually brought to Venice, and that he (Fuccarius) had seen it; which, even if true, is perfectly consistent with Galileo's statement; and in fact the question, whether or not Galileo saw the original instrument, becomes important only from his expressly asserting the contrary, and professing to give the train of reasoning by which he discovered its principle; so that any insinuation that he had actually seen the Dutch glass, becomes a direct impeachment of his veracity. It is certain, from the following extract of a letter from Lorenzo Pignoria to Paolo Gualdo, that one at least of the Dutch glasses had been sent to Italy. It is dated Padua, 31st August, 1609.* "We have no news, except the return of His Serene Highness, and the reelection of the lecturers, among whom Sign. Galileo has contrived to get 1000 florins for life; and it is said to be on account of an eyeglass, *like the one which was sent from Flanders to Cardinal Borghese.* We have seen some here, and truly they succeed well."

It is allowed by every one that the Dutchman, or rather Zealander, made his discovery by mere accident, which greatly derogates from any honour attached to it; but even this diminished degree of credit has been fiercely disputed. According to one account, which appears consistent and probable, it had been made for sometime before its importance was in the slightest degree understood or appreciated, but was set up in the optician's shop as a curious philosophical toy, showing a large and inverted image of a weathercock, towards which it was directed. The Marquis Spinola, chancing to see it, was struck with the phenomenon, purchased the instrument, and presented it either to the Archduke Albert of Austria, or to Prince Maurice of Nassau, whose name appears in every version of the story, and who first entertained the idea of employing it in military reconnoissances.

Zacharias Jansen, and Henry Lipperhey, two spectacle-makers, living close to each other, near the church of Middleburg, have both had strenuous supporters of their title to the invention. A third pretender appeared afterwards in the person of James Metius of Alkmaer, who is mentioned by Huyghens and Des Cartes, but his claims rest upon no authority whatever comparable to that which supports the other two. About half a century afterwards, Borelli was at the pains to collect and publish a number of letters and depositions which he procured, as well on one side as on the other.† It seems that the truth lies between them, and that one, probably Jansen, was the inventor of the *microscope*, which application of the principle was unquestionably of an earlier date, perhaps as far back as 1590. Jansen gave one of his microscopes to the Archduke, who gave it to Cornelius Drebbel, a salaried mathematician at the court of our James the first, where William Borelli (not the author above

* Lettère d'Uomini illustri. Venezia, 1744.

† Borelli. De vero Telescopii inventore, 1655.

mentioned) saw it many years afterwards, when ambassador from the United Provinces to England, and got from Drebbel this account of the quarter whence it came. Lipperhey afterwards, in 1609, accidentally hit upon the *telescope*, and on the fame of this discovery it would not be difficult for Jansen, already in possession of an instrument so much resembling it, to perceive the slight difference between them, and to construct a telescope independently of Lipperhey, so that each, with some show of reason, might claim the priority of the invention. A notion of this kind reconciles the testimony of many conflicting witnesses on the subject, some of whom do not seem to distinguish very accurately whether the telescope or microscope is the instrument to which their evidence refers. Borelli arrives at the conclusion, that Jansen was the inventor; but not satisfied with this, he endeavours, with a glaring partiality which makes his former determination suspicious, to secure for him and his son the more solid reputation of having anticipated Galileo in the useful employment of the invention. He has however inserted in his collections a letter from John the son of Zacharias, in which John, omitting all mention of his father, speaks of his own observation of the satellites of Jupiter, evidently seeking to insinuate that they were earlier than Galileo's; and in this sense the letter has since been quoted,* although it appears from John's own deposition, preserved in the same collection, that at the time of their discovery he could not have been more than six years old. An oversight of this sort throws doubt on the whole of the pretended observations, and indeed the letter has much the air of being the production of a person imperfectly informed on the subject on which he writes, and probably was compiled to suit Borelli's purposes, which were to make Galileo's share in the invention appear as small as possible.

Galileo himself gives a very intelligible account of the process of reasoning, by which he detected the secret.—"I argued in the following manner. The contrivance consists either of one glass or of more—one is not sufficient, since it must be either convex, concave, or plane; the last does not produce any sensible alteration in objects, the concave diminishes them: it is true that the convex magnifies, but it renders them confused and indistinct; consequently, one glass is insufficient to produce the desired effect. Proceeding to consider two glasses, and bearing in mind that the plane glass causes no change, I determined that the instrument could not consist of the combination of a plane glass with either of the other two. I therefore applied myself to make experiments on combinations of the two other kinds, and thus obtained that of which I was in search." It has been urged against Galileo that, if he really invented the telescope on theoretical principles, the same theory ought at once to have conducted him to a more perfect instrument than that which he at first constructed;* but it is plain, from this statement, that he does not profess to have theorized beyond the determination of the species of glass which he should employ in his experiments, and the rest of his operations he avows to have been purely empirical. Besides, we must take into account the difficulty of grinding the glasses, particularly when fit tools were yet to be made, and something must be attributed to Galileo's eagerness to bring his results to the test of actual experiment, without waiting for that improvement which a longer delay might and did suggest. Galileo's language bears a resemblance to the first passage which we quoted from Baptista Porta, sufficiently close to make it not improbable that he might be assisted in his inquiries by some recollection of it, and the same passage seems, in like manner, to have recurred to the mind of Kepler, as soon as he heard of the invention. Galileo's telescope consisted of a plano-convex and plano-concave lens, the latter nearest the eye, distant from each other by the difference of their focal lengths, being, in principle, exactly the same with the modern opera-glass. He seems to have thought that the Dutch glass was the same, but this could not be the case, if the above quoted particular of the *inverted* weathercock, which belongs to most traditions of the story, be correct; because it is the peculiarity of this kind of telescope not to invert objects, and we should be thus furnished with a demonstrative proof of the falsehood of Fuccarius's insinuation: in that case the Dutch glass must have been similar to what was afterwards called the astronomical telescope, consisting of two

* Encyclopædia Britannica. Art. TELESCOPE.

* Ibid.

convex glasses distant from each other by the sum of their focal lengths. This supposition is not controverted by the fact, that this sort of telescope was never employed by astronomers till long afterwards; for the fame of Galileo's observations, and the superior excellence of the instruments constructed under his superintendence, induced every one in the first instance to imitate his constructions as closely as possible. The astronomical telescope was however eventually found to possess superior advantages over that which Galileo imagined, and it is on this latter principle that all modern refracting telescopes are constructed; the inversion being counteracted in those which are intended for terrestrial observations, by the introduction of a second pair of similar glasses, which restore the inverted image to its original position. For further details on the improvements which have been subsequently introduced, and on the reflecting telescope, which was not brought into use till the latter part of the century, the reader is referred to the Treatise on OPTICAL INSTRUMENTS.

Galileo, about the same time, constructed microscopes on the same principle, for we find that, in 1612, he presented one to Sigismund, King of Poland; but his attention being principally devoted to the employment and perfection of his telescope, the microscope remained a long time imperfect in his hands: twelve years later, in 1624, he wrote to P. Federigo Cesi, that he had delayed to send the microscope, the use of which he there describes, because he had only just brought it to perfection, having experienced some difficulty in working the glasses. Schott tells an amusing story, in his "Magic of Nature," of a Bavarian philosopher, who, travelling in the Tyrol with one of the newly invented microscopes about him, was taken ill on the road and died. The authorities of the village took possession of his baggage, and were proceeding to perform the last duties to his body, when, on examining the little glass instrument in his pocket, which chanced to contain a flea, they were struck with the greatest astonishment and terror, and the poor Bavarian, condemned by acclamation as a sorcerer who was in the habit of using a portable familiar, was declared unworthy of Christian burial. Fortunately for his character, some bold sceptic ventured to open the instrument, and discovered the true nature of the imprisoned fiend.

As soon as Galileo's first telescope was completed, he returned with it to Venice, and the extraordinary sensation which it excited tends also strongly to refute Fuccarius's assertion that the Dutch glass was already known there. During more than a month Galileo's whole time was employed in exhibiting his instrument to the principal inhabitants of Venice, who thronged to his house to satisfy themselves of the truth of the wonderful stories in circulation; and at the end of that time the Doge, Leonardo Donati, caused it to be intimated to him that such a present would not be deemed unacceptable by the senate. Galileo took the hint, and his complaisance was rewarded by a mandate confirming him for life in his professorship at Padua, at the same time doubling his yearly salary, which was thus made to amount to 1000 florins.

It was long before the phrenzy of public curiosity abated. Sirturi describes a ludicrous violence which was done to himself, when, with the first telescope which he had succeeded in making, he went up into the tower of St. Mark, at Venice, in the vain hope of being there entirely unmolested. Unluckily he was seen by some idlers in the street: a crowd soon collected round him, who insisted on taking possession of his instrument, and, handing it one to the other, detained him there for several hours till their curiosity was satiated, when he was allowed to return home. Hearing them also inquire eagerly at what inn he lodged, he thought it better to quit Venice early the next morning, and prosecute his observations in a less inquisitive neighbourhood.* Instruments of an inferior description were soon manufactured, and vended every where as philosophical playthings, much in the way in which, in our own time, the kaleidoscope spread over Europe as fast as travellers could carry them. But the fabrication of a better sort was long confined, almost solely, to Galileo and those whom he immediately instructed; and so late as the year 1637, we find Gaertner, or as he chose to call himself, Hortensius, assuring Galileo that none could be met with in Holland sufficiently good to show Jupiter's disc well defined; and in 1634 Gassendi begs for a telescope from Galileo, informing

* Telescopium. Venetiis, 1619.

him that he was unable to procure a good one either in Venice, Paris, or Amsterdam.

The instrument, on its first invention, was generally known by the names of Galileo's tube, the perspective, the double eye-glass: the names of telescope and microscope were suggested by Demisiano, as we are told by Lagalla in his treatise on the Moon.*

## Chapter VII.

*Discovery of Jupiter's satellites—Kepler—Sizzi—Astrologers—Mæstlin—Horky—Mayer.*

As soon as Galileo had provided himself with a second instrument, he began a careful examination of the heavenly bodies, and a series of splendid discoveries soon rewarded his diligence. After considering the beautiful appearances which the varied surface of the moon presented to this new instrument, he turned his telescope towards Jupiter, and his attention was soon arrested by the singular position of three small stars, near the body of that planet, which appeared almost in a straight line with it, and in the direction of the ecliptic. The following evening he was surprised to find that two of the three which had been to the eastward of the planet, now appeared on the contrary side, which he could not reconcile with the apparent motion of Jupiter among the fixed stars, as given by the tables. Observing these night after night, he could not fail to remark that they changed their relative positions. A fourth also appeared, and in a short time he could no longer refuse to believe that these small stars were four moons, revolving round Jupiter in the same manner in which our earth is accompanied by its single attendant. In honour of his patron Cosmo, he named them the Medicæan stars. As they are now hardly known by this appellation, his doubts, whether he should call them Medicæan, after Cosmo's family, or Cosmical, from his individual name, are become of less interest.

An extract from a letter which Galileo received on this occasion from the court of France, will serve to show how highly the honour of giving a name to these new planets was at that time appreciated, and also how much was expected from Galileo's first success in examining the heavens. "The second request, but the most pressing one which I can make to you, is, that you should determine, if you discover any other fine star, to call it by the name of the great star of France, as well as the most brilliant of all the earth; and, if it seems fit to you, call it rather by his proper name of Henri, than by the family name of Bourbon: thus you will have an opportunity of doing a thing just and due and proper in itself, and at the same time will render yourself and your family rich and powerful for ever." The writer then proceeds to enumerate the different claims of Henri IV. to this honour, not forgetting that he married into the family of the Medici, &c.

The result of these observations was given to the world, in an Essay which Galileo entitled *Nuncius Sidereus*, or the Intelligencer of the Stars; and it is difficult to describe the extraordinary sensation which its publication produced. Many doubted, many positively refused to believe, so novel an announcement; all were struck with the greatest astonishment, according to their respective opinions, either at the new view of the universe thus offered to them, or at the daring audacity of Galileo in inventing such fables. We shall proceed to extract a few passages from contemporary writers relative to this book, and the discoveries announced in it.

Kepler deserves precedence, both from his own celebrity, and from the lively and characteristic account which he gives of his first receiving the intelligence: — "I was sitting idle at home, thinking of you, most excellent Galileo, and your letters, when the news was brought me of the discovery of four planets by the help of the double eye-glass. Wachenfels stopped his carriage at my door to tell me, when such a fit of wonder seized me at a report which seemed so very absurd, and I was thrown into such agitation at seeing an old dispute between us decided in this way, that between his joy, my colouring, and the laughter of both, confounded as we were by such a novelty, we were hardly capable, he of speaking, or I of listening. My amazement was increased by the assertion of Wachenfels, that those who sent this news from Galileo were celebrated men, far removed by their learning, weight, and character, above vulgar folly; that the book was actually in the press, and would be published immediately. On our separating, the authority of Galileo had the greatest influence on

* De phænomenis in orbe Lunæ. Venetiis, 1612.

me, earned by the accuracy of his judgment, and excellence of his understanding; so I immediately fell to thinking how there could be any addition to the number of the planets without overturning my Mysterium Cosmographicum, published thirteen years ago, according to which Euclid's five regular solids do not allow more than six planets round the sun."

This was one of the many wild notions of Kepler's fanciful brain, among which he was lucky enough at length to hit upon the real and principal laws of the planetary motions. His theory may be briefly given in his own words:—"The orbit of the earth is the measure of the rest. About it circumscribe a dodecahedron. The sphere including this will be that of Mars. About Mars' orbit describe a tetrahedron: the sphere containing this will be Jupiter's orbit. Round Jupiter's describe a cube: the sphere including this will be Saturn's. Within the earth's orbit inscribe an icosahedron: the sphere inscribed in it will be Venus's orbit. In Venus inscribe an octahedron: the sphere inscribed in it will be Mercury's. You have now the reason of the number of the planets:" for as there are no more than the five regular solids here enumerated, Kepler conceived this to be a satisfactory reason why there could be neither more nor less than six planets. His letter continues:—"I am so far from disbelieving the existence of the four circumjovial planets, that I long for a telescope to anticipate you, if possible, in discovering two round Mars, (as the proportion seems to me to require,) six or eight round Saturn, and perhaps one each round Mercury and Venus."

The reader has here an opportunity of verifying Galileo's observation, that Kepler's method of philosophizing differed widely from his own. The proper line is certainly difficult to hit between the mere theorist and the mere observer. It is not difficult at once to condemn the former, and yet the latter will deprive himself of an important, and often indispensable assistance, if he neglect from time to time to consolidate his observations, and thence to conjecture the course of future observation most likely to reward his assiduity. This cannot be more forcibly expressed than in the words of Leonardo da Vinci:* "Theory is the general, experiments are the soldiers. The interpreter of the works of nature is experiment; that is never wrong; it is our judgment which is sometimes deceived, because we are expecting results which experiment refuses to give. We must consult experiment, and vary the circumstances, till we have deduced general rules, for it alone can furnish us with them. But you will ask, what is the use of these general rules? I answer, that they direct us in our inquiries into nature and the operations of art. They keep us from deceiving ourselves and others, by promising ourselves results which we can never obtain."

In the instance before us, it is well known that, adopting some of the opinions of Bruno and Brutti, Galileo, even before he had seen the satellites of Jupiter, had allowed the possibility of the discovery of new planets; and we can scarcely suppose that they had weakened his belief in the probability of further success, or discouraged him from examining the other heavenly bodies. Kepler on the contrary had taken the opposite side of the argument; but no sooner was the fallacy of his first position undeniably demonstrated, than, passing at once from one extreme to the other, he framed an unsupported theory to account for the number of satellites which were round Jupiter, and for those which he expected to meet with elsewhere. Kepler has been styled the legislator of the skies; his laws were promulgated rather too arbitrarily, and they often failed, as all laws must do which are not drawn from a careful observation of the nature of those who are to be governed by them. Astronomers have reason to be grateful for the theorems which he was the first to establish; but so far as regards the progress of the science of inductive reasoning, it is perhaps to be regretted, that the seventeen years which he wasted in random and unconnected guesses should have been finally rewarded, by discoveries splendid enough to shed deceitful lustre upon the method by which he arrived at them.

Galileo himself clearly perceived the fallacious nature of these speculations on numbers and proportions, and has expressed his sentiments concerning them very unequivocally. "How great and common an error appears to me the mistake of those who persist in making their knowledge and apprehension the measure of the apprehension and knowledge of God; as if that alone were perfect, which they understand to be so. But I, on the contrary, observe that

* Venturi, Essai sur les ouvrages de Leo. da Vinci.

Nature has other scales of perfection, which we cannot comprehend, and rather seem disposed to class among imperfections. For instance, among the relations of different numbers, those appear to us most perfect which exist between numbers nearly related to each other; as the double, the triple, the proportion of three to two, &c.; those appear less perfect which exist between numbers remote from, and prime to each other; as 11 to 7, 17 to 13, 53 to 37, &c.; and most imperfect of all do those appear which exist between incommensurable quantities, which by us are nameless and inexplicable. Consequently, if the task had been given to a man, of establishing and ordering the rapid motions of the heavenly bodies, according to his notions of perfect proportions, I doubt not that he would have arranged them according to the former rational proportions; but, on the contrary, God, with no regard to our imaginary symmetries, has ordered them in proportions not only incommeasurable and irrational, but altogether inappreciable by our intellect. A man ignorant of geometry may perhaps lament, that the circumference of a circle does not happen to be exactly three times the diameter, or in some other assignable proportion to it, rather than such that we have not yet been able to explain what the ratio between them is; but one who has more understanding will know that if they were other than they are, thousands of admirable conclusions would have been lost, and that none of the other properties of the circle would have been true: the surface of the sphere would not be quadruple of a great circle, nor the cylinder be to the sphere as three to two: in short, no part of geometry would be true, and as it now is. If one of our most celebrated architects had had to distribute this vast multitude of fixed stars through the great vault of heaven, I believe he would have disposed them with beautiful arrangements of squares, hexagons, and octagons; he would have dispersed the larger ones among the middle sized and the less, so as to correspond exactly with each other; and then he would think he had contrived admirable proportions: but God, on the contrary, has shaken them out from His hand as if by chance, and we, forsooth, must think that He has scattered them up yonder without any regularity, symmetry, and elegance."

It is worth remarking that the dangerous ideas of aptitude and congruence of numbers had taken such deep and general root, that long afterwards, when the reality of Jupiter's satellites was incontestably established, and Huyghens had discovered a similar satellite near Saturn, he was so rash as to declare his belief, (unwarned by the vast progress which astronomy had made in his own time,) that no more satellites would be discovered, since the one which he discovered near Saturn, with Jupiter's four, and our moon, made up the number six, exactly equal to the number of the principal planets. Every reader knows that this notion, so unworthy the genius of Huyghens, has been since exploded by the discovery both of new planets, and new satellites.

Francesco Sizzi, a Florentine astronomer, took the matter up in a somewhat different strain from Kepler.*—"There are seven windows given to animals in the domicile of the head, through which the air is admitted to the rest of the tabernacle of the body, to enlighten, to warm, and nourish it, which are the principal parts of the μικροκοσμος (or little world); two nostrils, two eyes, two ears, and a mouth; so in the heavens, as in a μακροκοσμος (or great world), there are two favourable stars, two unpropitious, two luminaries, and Mercury alone undecided and indifferent. From which and many other similar phenomena of nature, such as the seven metals, &c., which it were tedious to enumerate, we gather that the number of planets is necessarily seven. Moreover, the satellites are invisible to the naked eye, and therefore can exercise no influence on the earth, and therefore would be useless, and therefore do not exist. Besides, as well the Jews and other ancient nations as modern Europeans have adopted the division of the week into seven days, and have named them from the seven planets: now if we increase the number of the planets this whole system falls to the ground." To these remarks Galileo calmly replied, that whatever their force might be, as a reason for believing beforehand that no more than seven planets would be discovered, they hardly seemed of sufficient weight to destroy the new ones when actually seen.

Others, again, took a more dogged line of opposition, without venturing into the subtle analogies and arguments of the philosopher just cited. They contented themselves, and satisfied others,

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* Dianoia Astronomica. Venetiis, 1610.

with the simple assertion, that such things were not, and could not be, and the manner in which they maintained themselves in their incredulity was sufficiently ludicrous. "Oh, my dear Kepler," * says Galileo, "how I wish that we could have one hearty laugh together. Here, at Padua, is the principal professor of philosophy, whom I have repeatedly and urgently requested to look at the moon and planets through my glass, which he pertinaciously refuses to do. Why are you not here? what shouts of laughter we should have at this glorious folly! and to hear the professor of philosophy at Pisa labouring before the grand duke with logical arguments, as if with magical incantations, to charm the new planets out of the sky."

Another opponent of Galileo deserves to be named, were it only for the singular impudence of the charge he ventures to bring against him. "We are not to think," says Christmann, in the Appendix to his *Nodus Gordius*, "that Jupiter has four satellites given him by nature, in order, by revolving round him, to immortalize the name of the Medici, who first had notice of the observation. These are the dreams of *idle men*, who love ludicrous ideas better than our laborious and industrious correction of the heavens.—Nature abhors so horrible a chaos, and to the truly wise such vanity is detestable.

Galileo was also urged by the astrologers to attribute some influence, according to their fantastic notions, to the satellites, and the account which he gives his friend Dini of his answer to one of this class is well worth extracting, as a specimen of his method of uniting sarcasm with serious expostulation; "I must," says he, "tell you what I said a few days back to one of those nativity-casters, who believe that God, when he created the heavens and the stars, had no thoughts beyond what they can themselves conceive, in order to free myself from his tedious importunity; for he protested, that unless I would declare to him the effect of the Medicæan planets, he would reject and deny them as needless and superfluous. I believe this set of men to be of Sizzi's opinion, that astronomers discovered the other seven planets, not by seeing them corporally in the skies, but only from their effects on earth,—much in the manner in which some houses are discovered to be haunted by evil spirits, not by seeing them, but from the extravagant pranks which are played there. I replied, that he ought to reconsider the hundred or thousand opinions which, in the course of his life, he might have given, and particularly to examine well the events which he had predicted with the help of Jupiter, and if he should find that all had succeeded conformably to his predictions, I bid him prophecy merrily on, according to his old and wonted rules; for I assured him that the new planets would not in any degree affect the things which are already past, and that in future he would not be a less fortunate conjuror than he had been: but if, on the contrary, he should find the events depending on Jupiter, in some trifling particulars not to have agreed with his dogmas and prognosticating aphorisms, he ought to set to work to find new tables for calculating the constitution of the four Jovial circulators at every bygone moment, and, perhaps, from the diversity of their aspects, he would be able, with accurate observations and multiplied conjunctions, to discover the alterations and variety of influences depending upon them; and I reminded him, that in ages past they had not acquired knowledge with little labour, at the expense of others, from written books, but that the first inventors acquired the most excellent knowledge of things natural and divine with study and contemplation of the vast book which nature holds ever open before those who have eyes in their forehead and in their brain; and that it was a more honourable and praiseworthy enterprize with their own watching, toil, and study, to discover something admirable and new among the infinite number which yet remain concealed in the darkest depths of philosophy, than to pass a listless and lazy existence, labouring only to darken the toilsome inventions of their neighbours, in order to excuse their own cowardice and inaptitude for reasoning, while they cry out that nothing can be added to the discoveries already made."

The extract given above from Kepler, is taken from an Essay, published with the later editions of the *Nuncius*, the object and spirit of which seem to have been greatly misunderstood, even by some of Kepler's intimate friends.—They considered it as a covert attack upon Galileo, and, accordingly, Maestlin thus writes to him:—"In your Essay

* Kepleri Epistolæ.

(which I have just received) you have plucked Galileo's feathers well; I mean, that you have shown him not to be the inventor of the telescope, not to have been the first who observed the irregularities of the moon's surface, not to have been the first discoverer of more worlds than the ancients were acquainted with, &c. One source of exultation was still left him, from the apprehension of which Martin Horky has now entirely delivered me." It is difficult to discover in what part of Kepler's book Maestlin found all this, for it is one continued encomium upon Galileo; insomuch that Kepler almost apologizes in the preface for what may seem his intemperate admiration of his friend. "Some might wish I had spoken in more moderate terms in praise of Galileo, in consideration of the distinguished men who are opposed to his opinions, but I have written nothing fulsome or insincere. I praise him, for myself; I leave other men's judgments free; and shall be ready to join in condemnation when some one wiser than myself shall, by sound reasoning, point out his errors." However, Maestlin was not the only one who misunderstood Kepler's intentions: the Martin Horky of whom he speaks, a young German, also signalized himself by a vain attack upon the book which he thought his patron Kepler condemned. He was then travelling in Italy, whence he wrote to Kepler his first undetermined thoughts about the new discoveries. "They are wonderful; they are stupendous; whether they are true or false I cannot tell." * He seems soon to have decided that most reputation was to be gained on the side of Galileo's opponents, and his letters accordingly became filled with the most rancorous abuse of him. At the same time, that the reader may appreciate Horky's own character, we shall quote a short sentence at the end of one of his letters, where he writes of a paltry piece of dishonesty with as great glee as if he had solved an ingenious and scientific problem. After mentioning his meeting Galileo at Bologna, and being indulged with a trial of his telescope, which, he says, "does wonders upon the earth, but represents celestial objects falsely;"† he concludes with the following honourable sentence:—"I must confide to you a theft which I committed. I contrived to take a mould of the glass in wax, without the knowledge of any one, and, when I get home, I trust to make a telescope even better than Galileo's own."

Horky having declared to Kepler, "I will never concede his four new planets to that Italian from Padua though I die for it," followed up this declaration by publishing a book against Galileo, which is the one alluded to by Maestlin, as having destroyed the little credit which, according to his view, Kepler's publication had left him. This book professes to contain the examination of four principal questions touching the alleged planets; 1st, Whether they exist? 2nd, What they are? 3rd, What they are like? 4th, Why they are? The first question is soon disposed of, by Horky's declaring positively that he has examined the heavens with Galileo's own glass, and that no such thing as a satellite about Jupiter exists. To the second, he declares solemnly, that he does not more surely know that he has a soul in his body, than that reflected rays are the sole cause of Galileo's erroneous observations. In regard to the third question, he says, that these planets are like the smallest fly compared to an elephant; and, finally, concludes on the fourth, that the only use of them is to gratify Galileo's "thirst of gold," and to afford himself a subject of discussion.*

Galileo did not condescend to notice this impertinent folly; it was answered by Roffini, a pupil of Magini, and by a young Scotchman of the name of Wedderburn, then a student at Padua, and afterwards a physician at the Court of Vienna. In the latter reply we find it mentioned, that Galileo was also using his telescope for the examination of insects,

* Kepleri Epistolæ.

† It may seem extraordinary that any one could support an argument by this partial disbelief in the instrument, which was allowed on all hands to represent terrestial objects correctly. A similar instance of obstinacy, in an almost identical case though in a more unpretending station, once came under the writer's own observation. A farmer in Cambridgeshire, who had acquired some confused notions of the use of the quadrant, consulted him on a new method of determining the distances and magnitudes of the sun and moon, which he declared were far different from the quantities usually assigned to them. After a little conversation, the root of his error, certainly sufficiently gross, appeared to be that he had confounded the angular measure of a degree, with 69½ miles, the linear measure of a degree on the earth's surface. As a short way of showing his mistake, he was desired to determine, in the same manner, the height of his barn which stood about 30 yards distant; he lifted the quadrant to his eye, but perceiving, probably, the monstrous size to which his principles were forcing him, he said, "Oh, Sir, the quadrant's only true for the sky." He must have been an objector of this kind, who said to Galileo.—"Oh, Sir, the telescope's only true for the earth."

* Venturi.

&c.* Horky sent his performance triumphantly to Kepler, and, as he returned home before receiving an answer, he presented himself before his patron in the same misapprehension under which he had written, but the philosopher received him with a burst of indignation which rapidly undeceived him. The conclusion of the story is characteristic enough to be given in Kepler's own account of the matter to Galileo, in which, after venting his wrath against this "scum of a fellow," whose "obscurity had given him audacity," he says, that Horky begged so hard to be forgiven, that "I have taken him again into favour upon this preliminary condition, to which he has agreed :—that I am to shew him Jupiter's satellites, AND HE IS TO SEE THEM, and own that they are there."

In the same letter Kepler writes, that although he has himself perfect confidence in the truth of Galileo's assertions, yet he wishes he could furnish him with some corroborative testimonies, which Kepler could quote in arguing the point with others. This request produced the following reply, from which the reader will also learn the new change which had now taken place in Galileo's fortunes, the result of the correspondence with Florence, part of which we have already extracted.† "In the first place, I return you my thanks that you first, and almost alone, before the question had been sifted (such is your candour and the loftiness of your mind), put faith in my assertions. You tell me you have some telescopes, but not sufficiently good to magnify distant objects with clearness, and that you anxiously expect a sight of mine, which magnifies images more than a thousand times. It is mine no longer, for the Grand Duke of Tuscany has asked it of me, and intends to lay it up in his museum, among his most rare and precious curiosities, in eternal remembrance of the invention : I have made no other of equal excellence, for the mechanical labour is very great : I have, however, devised some instruments for figuring and polishing them which I am unwilling to construct here, as they could not conveniently be carried to Florence, where I shall in future reside. You ask, my dear Kepler, for other testimonies : — I produce, for one, the Grand Duke, who, after observing the Medicæan planets several times with me at Pisa during the last months, made me a present, at parting, worth more than a thousand florins, and has now invited me to attach myself to him with the annual salary of one thousand florins, and with the title of Philosopher and Principal Mathematician to His Highness; without the duties of any office to perform, but with the most complete leisure ; so that I can complete my Treatises on Mechanics, on the Constitution of the Universe, and on Natural and Violent Local Motion, of which I have demonstrated geometrically many new and admirable phenomena. I produce, for another witness, myself, who, although already endowed in this college with the noble salary of one thousand florins, such as no professor of mathematics ever before received, and which I might securely enjoy during my life, even if these planets had deceived me and should disappear, yet quit this situation, and betake me where want and disgrace will be my punishment should I prove to have been mistaken."

It is difficult not to regret that Galileo should be thus called on to resign his best glasses, but it appears probable that on becoming more familiar with the Grand Duke, he ventured to suggest that this telescope would be more advantageously employed in his own hands, than pompously laid up in a museum ; for in 1637 we find him saying, in answer to a request from his friend Micanzio to send him a telescope—"I am sorry that I cannot oblige you with the glasses for your friend, but I am no longer capable of making them, and I have just parted with two tolerably good ones which I had, reserving only my old discoverer of celestial novelties which is already promised to the Grand Duke. Cosmo was dead in 1637, and it is his son Ferdinand who is here meant, who appears to have inherited his father's love of science. Galileo tells us, in the same letter, that Ferdinand had been amusing himself for some months with making object-glasses, and always carried one with him to work at wherever he went.

When forwarding this telescope to Cosmo in the first instance, Galileo adds, with a very natural feeling—"I send it to his highness unadorned and unpolished, as I made it for my own use, and beg that it may always be left in the same state ; for none of the old parts ought to be displaced to make room for new ones, which will have had no share in the watchings and fatigues

* Quatuor probl. confut. per J. Wedderbornium, Scotobritannum. Patavii. 1610.

† See page 18.

of these observations." A telescope was in existence, though with the object glass broken, at the end of the last century, and probably still is in the Museum at Florence, which was shewn as the discoverer of Jupiter's satellites. Nelli, on whose authority this is mentioned, appears to question its genuineness. The first reflecting telescope, made with Newton's own hands, and scarcely possessing less interest than the first of Galileo's, is preserved in the library of the Royal Society.

By degrees the enemies of Galileo and of the new stars found it impossible to persevere in their disbelief, whether real or pretended, and at length seemed resolved to compensate for the sluggishness of their perception, by its acuteness when brought into action. Simon Mayer published his "Mundus Jovialis" in 1614, in which he claims to have been an original observer of the satellites, but, with an affectation of candour, allows that Galileo observed them probably about the same time. The earliest observation which he has recorded is dated 29th December, 1609, but, not to mention the total want of probability that Mayer would not have immediately published so interesting a discovery, it is to be observed, that, as he used the old style, this date of 29th December agrees with the 8th January, 1610, of the new style, which was the date of Galileo's second observation, and Galileo ventured to declare his opinion, that this pretended observation was in fact a plagiarism.

Scheiner counted five, Rheita nine, and other observers, with increasing contempt for Galileo's imperfect announcements, carried the number as high as twelve.* In imitation of Galileo's nomenclature, and to honour the sovereigns of the respective observers, these supposed additional satellites were dignified with the names of Vladislavian, Agrippine, Urbanoctavian, and Ferdinandotertian planets; but a very short time served to show it was as unsafe to exceed as to fall short of the number which Galileo had fixed upon, for Jupiter rapidly removed himself from the neighbourhood of the fixed stars, which gave rise to these pretended discoveries, carrying with him only his four original attendants, which continued in every part of his orbit to revolve regularly about him.

Perhaps we cannot better wind up this account of the discovery of Jupiter's satellites, and of the intense interest they have at all times inspired, than in the words of one who inherits a name worthy to be ranked with that of Galileo in the list of astronomical discoverers, and who takes his own place among the most accomplished mathematicians of the present times. "The discovery of these bodies was one of the first brilliant results of the invention of the telescope; one of the first great facts which opened the eyes of mankind to the system of the universe, which taught them the comparative insignificance of their own planet, and the superior vastness and nicer mechanism of those other bodies, which had before been distinguished from the stars only by their motion, and wherein none but the boldest thinkers had ventured to suspect a community of nature with our own globe. This discovery gave the holding turn to the opinions of mankind respecting the Copernican system; the analogy presented by these little bodies (little however only in comparison with the great central body about which they revolve) performing their beautiful revolutions in perfect harmony and order about it, being too strong to be resisted. This elegant system was watched with all the curiosity and interest the subject naturally inspired. The eclipses of the satellites speedily attracted attention, and the more when it was discerned, as it speedily was, by Galileo himself, that they afforded a ready method of determining the difference of longitudes of distant places on the earth's surface, by observations of the instants of their disappearances and reappearances, simultaneously made. Thus the first astronomical solution of the great problem of the longitude, the first mighty step which pointed out a connection between speculative astronomy and practical utility, and which, replacing the fast dissipating dreams of astrology by nobler visions, showed how the stars might really, and without fiction, be called arbiters of the destinies of empires, we owe to the satellites of Jupiter, those atoms imperceptible to the naked eye, and floating like motes in the beam of their primary—itself an atom to our sight, noticed only by the careless vulgar as a large star, and by the philosophers of former ages as something moving among the stars, they knew not what, nor why: perhaps only to perplex the wise with fruitless conjectures, and harass the weak with fears as idle as their theories."*

* Sherburne's Sphere of Manilius. London, 1675.

* Herschel's Address to the Astronomical Society, 1827.

## Chapter VIII.

*Observations on the Moon—Nebulæ—Saturn—Venus—Mars.*

There were other discoveries announced in Galileo's book of great and unprecedented importance, and which scarcely excited less discussion than the controverted Medicæan planets. His observations on the moon threw additional light on the constitution of the solar system, and cleared up the difficulties which encumbered the explanation of the varied appearance of her surface. The different theories current at that day, to account for these phenomena, are collected and described by Benedetti, and also with some liveliness, in a mythological poem, by Marini.* We are told, that, in the opinion of some, the dark shades on the moon's surface arise from the interposition of opaque bodies floating between her and the sun, which prevents his light from reaching those parts: others thought, that on account of her vicinity to the earth, she was partly tainted with the imperfection of our terrestrial and elementary nature, and was not of that entirely pure and refined substance of which the more remote heavens consist: a third party looked on her as a vast mirror, and maintained that the dark parts of her surface were the reflected images of our earthly forests and mountains.

Galileo's glass taught him to believe that the surface of this planet, far from being smooth and polished, as was generally taken for granted, really resembled our earth in its structure; he was able distinctly to trace on it the outlines of mountains and other inequalities, the summits of which reflected the rays of the sun before these reached the lower parts, and the sides of which, turned from his beams, lay buried in deep shadow. He recognised a distribution into something similar to continents of land, and oceans of water, which reflect the sun's light to us with greater or less vivacity, according to their constitution. These conclusions were utterly odious to the Aristotelians; they had formed a preconceived notion of what the moon ought to be, and they loathed the doctrines of Galileo, who took delight, as they said, in distorting and ruining the fairest works of nature. It was in vain he argued, as to the imaginary perfection of the spherical form, that although the moon, or the earth, were it absolutely smooth, would indeed be a more perfect sphere than in its present rough state, yet touching the perfection of the earth, considered as a natural body calculated for a particular purpose, every one must see that absolute smoothness and sphericity would make it not only less perfect, but as far from being perfect as possible. "What else," he demanded, "would it be but a vast unblessed desert, void of animals, of plants, of cities and of men; the abode of silence and inaction; senseless, lifeless, soulless, and stript of all those ornaments which make it now so various and so beautiful?"

He reasoned to no purpose with the slaves of the ancient schools: nothing could console them for the destruction of their smooth unalterable surface, and to such an absurd length was this hallucination carried, that one opponent of Galileo, Lodovico delle Colombe, constrained to allow the evidence of the sensible inequalities of the moon's surface, attempted to reconcile the old doctrine with the new observations, by asserting, that every part of the moon, which to the terrestrial observer appeared hollow and sunken, was in fact entirely and exactly filled up with a clear crystal substance, perfectly imperceptible by the senses, but which restored to the moon her accurately spherical and smooth surface. Galileo met the argument in the manner most fitting, according to one of Aristotle's own maxims, that "it is foolish to refute absurd opinions with too much curiosity." "Truly," says he, "the idea is admirable, its only fault is that it is neither demonstrated nor demonstrable; but I am perfectly ready to believe it, provided that, with equal courtesy, I may be allowed to raise upon your smooth surface, crystal mountains (which nobody can perceive) ten times higher than those which I have actually seen and measured." By threatening to proceed to such extremities, he seems to have scared the opposite party into moderation, for we do not find that the crystalline theory was persevered in.

In the same essay, Galileo also explained at some length the cause of that part of the moon being visible, which is unenlightened directly by the sun in her first and last quarter. Maestlin, and before him Leonardo da Vinci, had already declared this to arise from what may be called *earthshine*, or the reflec-

* Adone di Marini, Venetiis, 1623, Cant. x.

tion of the sun's light from the terrestrial globe, exactly similar to that which the moon affords us when we are similarly placed between her and the sun; but the notion had not been favourably received, because one of the arguments against the earth being a planet, revolving like the rest round the sun, was, that it did not shine like them, and was therefore of a different nature; and this argument, weak as it was in itself, the theory of terrestrial reflection completely overturned. The more popular opinions ascribed this feeble light, some to the fixed stars, some to Venus, some to the rays of the sun, penetrating and shining through the moon. Even the sagacious Benedetti adopted the notion of this light being caused by Venus, in the same sentence in which he explains the true reason of the faint light observed during a total eclipse of the moon, pointing out that it is occasioned by those rays of the sun, which reach the moon, after being bent round the sides of the earth by the action of our atmosphere.*

Galileo also announced the detection of innumerable stars, invisible to the unassisted sight; and those remarkable appearances in the heavens, generally called nebulæ, the most considerable of which is familiar to all under the name of the milky way, when examined by his instrument, were found to resolve themselves into a vast collection of minute stars, too closely congregated to produce a separate impression upon the unassisted eye.† Benedetti, who divined that the dark shades on the moon's surface arose from the constitution of those parts which suffered much of the light to pass into them, and consequently reflected a less portion of it, had maintained that the milky way was the result of the converse of the same phenomenon, and declared, in the language of his astronomy, that it was a part of the eighth orb, which did not, like the rest, allow the sun's light to traverse it freely, but reflected a small part feebly to our sight.

The Anti-Copernicans would probably have been well pleased, if by these eternally renewed discussions and disputes, they could have occupied Galileo's time sufficiently to detain his attention from his telescope and astronomical observations; but he knew too well where his real strength lay, and they had scarcely time to compound any thing like an argument against him and his theories, before they found him in possession of some new facts, which they were unprepared to meet, otherwise than by the never-failing resource of abuse and affected contempt. The year had not expired before Galileo had new intelligence to communicate of the highest importance. Perhaps he had been taught caution from the numerous piracies which had been committed upon his discoveries, and he first announced his new discoveries enigmatically, veiling their real import by transpositions of the letters in the words which described them, (a practice then common, and not disused even at a much later date,) and inviting all astronomers to declare, within a certain time, if they had noted any thing new in the heavens worthy of observation. The transposed letters which he published were—

"*Smaismrmilme poeta leumi bvne nugttaviras.*"

Kepler, in the true spirit of his riddling philosophy, endeavoured to decypher the meaning, and fancied he had succeeded when he formed a barbarous Latin verse,

"*Salve umbistineum geminatum Martia proles,*"

conceiving that the discovery, whatever it might be, related to the planet Mars, to which Kepler's attention had before been particularly directed. The reader, however, need not weary himself in seeking a translation of this solution, for at the request of the Emperor Rodolph, Galileo speedily sent to him the real reading—

*Altissimum planetam tergeminum observavi;*

that is, "I have observed that the most distant planet is triple," or, as he further explains the matter, "I have with great admiration observed that Saturn is not a single star, but three together, which as it were touch each other; they have no relative motion, and are constituted in this form oOo the middle being somewhat larger than the lateral ones. If we examine them with an eye-glass which magnifies the surface less than 1000 times, the three stars do not appear very distinctly, but Saturn has an oblong appearance, like the appearance of an olive, thus ⬭. Now I have discovered a court for Jupiter, and two servants for this old man, who aid his

* Speculat. Lib Venetiis, 1585, Epistolæ.

† This opinion, with respect to the milky way, had been held by some of the ancient astronomers. *See* Manilius. Lib. i. v. 753.

"*Anne magis densâ stellarum turba coronâ*
*Contexit flammas, et crasso lumine candet,*
*Et fulgore nitet collato clarior orbis.*"

steps and never quit his side." Galileo was, however, no match in this style of writing for Kepler, who disapproved his friend's metaphor, and, in his usual fanciful and amusing strain,—" I will not," said he, " make an old man of Saturn, nor slaves of his attendant globes, but rather let this tricorporate form be Geryon, so shall Galileo be Hercules, and the telescope his club; armed with which, he has conquered that distant planet, and dragged him from the remotest depths of nature, and exposed him to the view of all." Galileo's glass was not of sufficient power to shew him the real constitution of this extraordinary planet; it was reserved for Huyghens, about the year 1656, to declare to the world that these supposed attendant stars are in fact part of a ring which surrounds, and yet is completely distinct from the body of Saturn;* and the still more accurate observations of Herschel have ascertained that it consists of two concentric rings revolving round the planet, and separated from each other by a space which our most powerful telescopes scarcely enable us to measure.

Galileo's second statement concluded with the remark, that " in the other planets nothing new was to be observed;" but a month had scarcely elapsed, before he communicated to the world another enigma,

*Hæc immatura à me jam frustra leguntur oy,*

which, as he said, contained the announcement of a new phenomenon, in the highest degree important to the truth of the Copernican system. The interpretation of this is,

*Cynthiæ figuras æmulatur mater amorum,*

that is to say,—Venus rivals the appearances of the moon — for Venus being now arrived at that part of her orbit in which she is placed between the earth and the sun, and consequently, with only a part of her enlightened surface turned towards the earth, the telescope shewed her in a crescent form, like the moon in a similar position, and tracing her through the whole of her orbit round the sun, or at least so long as she was not invisible from his overpowering light, Galileo had the satisfaction of seeing the enlightened portion in each position assume the form appropriate to that hypothesis. It was with reason, therefore, that he laid stress on the importance of this observation, which also established another doctrine scarcely less obnoxious to the Anti-Copernicans, namely, that a new point of resemblance was here found between the earth and one of the principal planets; and as the reflection from the earth upon the moon had shewn it to be luminous like the planets when subjected to the rays of the sun, so this change of apparent figure demonstrated that one of the planets not near the earth, and therefore probably all, were in their own nature not luminous, and only reflected the sun's light which fell upon them; an inference, of which the probability was still farther increased a few years later by the observation of the transit of Mercury over the sun's disc.

It is curious that only twenty-five years before this discovery of the phases (or appearances) of Venus, a commentator of Aristotle, under the name of Lucillus Philalthæus, had advanced the doctrine that all the planets except the moon are luminous of themselves, and in proof of his assertion had urged, " that if the other planets and fixed stars received their light from the sun, they would, as they approached and receded from him, or as he approached and receded from them, assume the same phases as the moon, which, he adds, we have never yet observed."—He further remarks, " that Mercury and Venus would, in the supposed case of their being nearer the earth than the sun, eclipse it occasionally, just as eclipses are occasioned by the moon." Perhaps it is still more remarkable, that these very passages, in which the reasoning is so correct, though the facts are too hastily taken for granted, (the common error of that school,) are quoted by Benedetti, expressly to shew the ignorance and presumption of the author. Copernicus, whose want of instruments had prevented him from observing the horned appearance of Venus when between the earth and sun, had perceived how formidable an obstacle the non-appearance of this phenomenon presented to his system; he endeavoured, though unsatisfactorily, to account for it by supposing that the rays of the sun passed freely through the body of the planet, and Galileo takes occasion to praise him for not being deterred from

* Huyghens announced his discovery in this form: *a a a a a a a c c c c c d e e e e e g h i i i i i i i l l l l m m n n n n n n n n n o o o o p p q r r s t t t t t u u u u u*, which he afterwards recomposed into the sentence. *Annulo cingitur, tenui, plano, nusquam cohærente, ad eclipticam inclinato.* De Saturni Lunâ. Hagæ, 1656.

adopting the system, which, on the whole, appeared to agree best with the phenomena, by meeting with some which it did not enable him to explain. Milton, whose poem is filled with allusions to Galileo and his astronomy, has not suffered this beautiful phenomenon to pass unnoticed. After describing the creation of the Sun, he adds:—

> Hither, as to their fountain, other stars
> Repairing, in their golden urns draw light,
> And hence the morning planet gilds her horns.*

Galileo also assured himself, at the same time, that the fixed stars did not receive their light from the sun. This he ascertained by comparing the vividness of their light, in all positions, with the feebleness of that of the distant planets, and by observing the different degrees of brightness with which all the planets shone at different distances from the sun. The more remote planets did not, of course, afford equal facilities with Venus for so decisive an observation; but Galileo thought he observed, that when Mars was in quadratures, (or in the quarters, the middle points of his path on either side,) his figure varied slightly from a perfect circle. Galileo concludes the letter, in which he announces these last observations to his pupil Castelli, with the following expressions, shewing how justly he estimated the opposition they encountered:—"You almost make me laugh by saying that these clear observations are sufficient to convince the most obstinate: it seems you have yet to learn that long ago the observations were enough to convince those who are capable of reasoning, and those who wish to learn the truth; but that to convince the obstinate, and those who care for nothing beyond the vain applause of the stupid and senseless vulgar, not even the testimony of the stars would suffice, were they to descend on earth to speak for themselves. Let us then endeavour to procure some knowledge for ourselves, and rest contented with this sole satisfaction; but of advancing in popular opinion, or gaining the assent of the book-philosophers, let us abandon both the hope and the desire."

## Chapter IX.

*Account of the Academia Lincea—Del Cimento—Royal Society.*

Galileo's resignation of the mathematical professorship at Padua occasioned much dissatisfaction to all those who were connected with that university. Perhaps not fully appreciating his desire of returning to his native country, and the importance to him and to the scientific world in general, of the complete leisure which Cosmo secured to him at Florence, (for by the terms of his diploma he was not even required to reside at Pisa, nor to give any lectures, except on extraordinary occasions, to sovereign princes and other strangers of distinction,) the Venetians remembered only that they had offered him an honourable asylum when almost driven from Pisa; that they had increased his salary to four times the sum which any previous professor had enjoyed; and, finally, by an almost unprecedented decree, that they had but just secured him in his post during the remainder of his life. Many took such offence as to refuse to have any further communication with him; and Sagredo, a constant friend of Galileo, wrote him word that he had been threatened with a similar desertion unless he should concur in the same peremptory resolution, which threats, however, Sagredo, at the same time, intimates his intention of braving.

Early in the year 1611, Galileo made his first appearance in Rome, where he was received with marks of distinguished consideration, and where all ranks were eager to share the pleasure of contemplating the new discoveries. "Whether we consider cardinal, prince, or prelate, he found an honourable reception from them all, and had their palaces as open and free to him as the houses of his private friends."* Among other distinctions he was solicited to become a member of the newly-formed philosophical society, the once celebrated *Academia Lincea*, to which he readily assented. The founder of this society was Federigo Cesi, the Marchese di Monticelli, a young Roman nobleman, the devotion of whose time and fortune to the interests of science has not been by any means rewarded with a reputation commensurate with his deserts. If the energy of his mind had been less worthily employed than in fostering the cause of science and truth, and in extending the advantages of his birth and fortune to as many as were willing to co-operate with him, the name of Federigo Cesi might have appeared more prominently on the page of history. Cesi had scarcely completed

* B. vii. v. 364. Other passages may be examined in B. i. 286; iii. 565—590, 722—733; iv. 589; v. 261, 414; vii. 577; viii. 1—178.

* Salusbury, Math. Coll.

his 18th year, when, in 1603, he formed the plan of a philosophical society, which in the first instance consisted only of himself and three of his most intimate friends, Hecke, a Flemish physician, Stelluti, and Anastasio de Filiis. Cesi's father, the Duca d' Acquasparta, who was of an arbitrary and extravagant temper, considered such pursuits and associates as derogatory to his son's rank; he endeavoured to thwart the design by the most violent and unjustifiable proceedings, in consequence of which, Cesi in the beginning of 1605 privately quitted Rome, Hecke was obliged to leave Italy altogether from fear of the Inquisition, which was excited against him, and the academy was for a time virtually dissolved. The details of these transactions are foreign to the present narrative: it will be enough to mention that, in 1609, Cesi, who had never altogether abandoned his scheme, found the opposition decaying which he at first experienced, and with better success he renewed the plan which he had sketched six years before. A few extracts from the Regulations will serve to shew the spirit in which this distinguished society was conceived:—

"The Lyncean Society desires for its academicians, philosophers eager for real knowledge, who will give themselves to the study of nature, and especially to mathematics; at the same time it will not neglect the ornaments of elegant literature and philology, which like a graceful garment adorn the whole body of science.—In the pious love of wisdom, and to the praise of the most good and most high God, let the Lynceans give their minds, first to observation and reflection, and afterwards to writing and publishing.—It is not within the Lyncean plan to find leisure for recitations and declamatory assemblies; the meetings will neither be frequent nor full, and chiefly for transacting the necessary business of the society: but those who wish to enjoy such exercises will in no respect be hindered, provided they attend them as accessory studies, decently and quietly, and without making promises and professions of how much they are about to do. For there is ample philosophical employment for every one by himself, particularly if pains are taken in travelling and in the observation of natural phenomena, and in the book of nature which every one has at home, that is to say, the heavens and the earth; and enough may be learned from the habits of constant correspondence with each other, and alternate offices of counsel and assistance.—Let the first fruits of wisdom be love; and so let the Lynceans love each other as if united by the strictest ties, nor suffer any interruption of this sincere bond of love and faith, emanating from the source of virtue and philosophy.—Let them add to their names the title of Lyncean, which has been advisedly chosen as a warning and constant stimulus, especially when they write on any literary subject, also in their private letters to their associates, and in general when any work comes from them wisely and well performed.—The Lynceans will pass over in silence all political controversies and quarrels of every kind, and wordy disputes, especially gratuitous ones, which give occasion to deceit, unfriendliness, and hatred; like men who desire peace, and seek to preserve their studies free from molestation, and to avoid every sort of disturbance. And if any one by command of his superiors, or from some other necessity, is reduced to handle such matters, since they are foreign to physical and mathematical science, and consequently alien to the object of the Academy, let them be printed without the Lyncean name." *

The society which was eventually organized formed but a very trifling part of the comprehensive scheme which Cesi originally proposed to himself; it had been his wish to establish a scientific Order which should have corresponding lodges in the principal towns of Europe, and in other parts of the globe, each consisting of not more than five nor less than three members, besides an unlimited number of Academicians not restricted to any particular residence or regulations. The mortifications and difficulties to which he was subjected from his father's unprincipled behaviour, render it most extraordinary and admirable that he should have ventured to undertake even so much as he actually carried into execution. He promised to furnish to the members of his society such assistance as they might require in the prosecution of their respective researches, and also to defray the charges

* Perhaps it was to deprecate the hostility of the Jesuits that, at the close of these Regulations, the Lynceans are directed to address their prayers, among other Saints, especially to Ignatius Loyola, as to one who greatly favoured the interests of learning. Odescalchi. Memorie dell' Acad. de' Lincei, Roma. 1806.

of publishing such of their works as should be thought worthy of appearing with the common sanction. Such liberal offers were not likely to meet with an unfavourable reception: they were thankfully accepted by many well qualified to carry his design into execution, and Cesi was soon enabled formally to open his academy, the distinctive title of which he borrowed from the Lynx, with reference to the piercing sight which that animal has been supposed to possess. This quality seemed to him an appropriate emblem of those which he desired to find in his academicians, for the purpose of investigating the secrets of nature; and although, at the present day, the name may appear to border on the grotesque, it was conceived in the spirit of the age, and the fantastic names of the numberless societies which were rapidly formed in various parts of Italy far exceed whatever degree of quaintness may be thought to belong to the Lyncean name. The Inflamed — the Transformed — the Uneasy — the Humorists—the Fantastic—the Intricate—the Indolent—the Senseless—the Undeceived—the Valiant — the Ætherial Societies are selected from a vast number of similar institutions, the names of which, now almost their sole remains, are collected by the industry of Morhof and Tiraboschi*. The Humorists are named by Morhof as the only Italian philosophical society anterior to the Lynceans; their founder was Paolo Mancino, and the distinctive symbol which they adopted was rain dropping from a cloud, with the motto *Redit agmine dulci*;—their title is derived from the same metaphor. The object of their union appears to have been similar to that of the Lynceans, but they at no time attained to the celebrity to which Cesi's society rose from the moment of its incorporation. Cesi took the presidency for his life, and the celebrated Baptista Porta was appointed vice president at Naples. Stelluti acted as the legal representative of the society, with the title of procuratore. Of the other two original members Anastasio de Filiis was dead, and although Hecke returned to Italy in 1614, and rejoined the Academy, yet he was soon afterwards struck off the list in consequence of his lapsing into insanity. Among the academicians we find the names of Galileo, Fabio Colonna, Lucas Valerio, Guiducci, Welser, Giovanni Fabro, Terrentio, Virginio Cesarini, Ciampoli, Molitor, Cardinal Barberino, (nephew of Pope Urban VIII.) Stelliola, Salviati, &c.

The principal monument still remaining of the zeal and industry to which Cesi incited his academicians is the Phytobasanos, a compendium of the natural history of Mexico, which must be considered a surprising performance for the times in which it appeared. It was written by a Spaniard named Hernandez; and Reccho, who often has the credit of the whole work, made great additions to it. During fifty years the manuscript had been neglected, when Cesi discovered it, and employed Terrentio, Fabro, and Colonna, all Lynceans, to publish it enriched with their notes and emendations. Cesi himself published several treatises, two of which are extant; his *Tabulæ Phytosophicæ*, and a Dissertation on Bees entitled *Apiarium*, the only known copy of which last is in the library of the Vatican. His great work, *Theatrum Naturæ*, was never printed; a circumstance which tends to shew that he did not assemble the society round him for the purpose of ministering to his own vanity, but postponed the publication of his own productions to the labours of his coadjutors. This, and many other valuable works belonging to the academy existed in manuscript till lately in the Albani Library at Rome. Cesi collected, not a large, but an useful library for the use of the academy, (which was afterwards augmented on the premature death of Cesarini by the donation of his books); he filled a botanical garden with the rarer specimens of plants, and arranged a museum of natural curiosities; his palace at Rome was constantly open to the academicians; his purse and his influence were employed with equal liberality in their service.

Cesi's death, in 1632, put a sudden stop to the prosperity of the society, a consequence which may be attributed to the munificence with which he had from the first sustained it: no one could be found to fill his place in the princely manner to which the academicians were accustomed, and the society, after lingering some years under the nominal patronage of Urban VIII., gradually decayed, till, by the death of its principal members, and dispersion of the rest, it became entirely extinct*. Bianchi,

* Polyhistor Literarius, &c.—Storia della Letterat. Ital. The still existing society of Chaff, more generally known by its Italian title, Della Crusca, belongs to the same period.

* F. Colonnæ Phytobasanus Jano Planco Auctore. Florent, 1744.

whose sketch of the academy was almost the only one till the appearance of Odescalchi's history, made an attempt to revive it in the succeeding century, but without any permanent effect. A society under the same name has been formed since 1784, and is still flourishing in Rome. Before leaving the subject it may be mentioned, that one of the earliest notices that Bacon's works were known in Italy is to be found in a letter to Cesi, dated 1625; in which Pozzo, who had gone to Paris with Cardinal Barberino, mentions having seen them there with great admiration, and suggests that Bacon would be a fit person to be proposed as a member of their society. After Galileo's death, three of his principal followers, Viviani, Torricelli, and Aggiunti formed the plan of establishing a similar philosophical society, and though Aggiunti and Torricelli died before the scheme could be realized, Viviani pressed it forward, and, under the auspices of Ferdinand II., formed a society, which, in 1657, merged in the famous *Academia del Cimento*, or Experimental Academy. This latter held its occasional meetings at the palace of Ferdinand's brother, Leopold de' Medici: it was composed chiefly, if not entirely, of Galileo's pupils and friends. During the few years that this society lasted, one of the principal objects of which was declared to be the repetition and developement of Galileo's experiments, it kept up a correspondence with the principal philosophers in every part of Europe, but when Leopold was, in 1666, created a cardinal, it appears to have been dissolved, scarcely ten years after its institution*. This digression may be excused in favour of so interesting an establishment as the Academia Lincea, which preceded by half a century the formation of the Royal Society of London, and Académie Françoise of Paris.

These latter two are mentioned together, probably for the first time, by Salusbury. The passage is curious in an historical point of view, and worth extracting:—"In imitation of these societies, Paris and London have erected theirs of *Les Beaux Esprits*, and of the *Virtuosi*: the one by the countenance of the most eminent Cardinal Richelieu, the other by the royal encouragement of his sacred Majesty that now is. The *Beaux Esprits* have published sundry volumes of their moral and physiological conferences, with the laws and history of their fellowship; and I hope the like in due time from our Royal Society; that so such as envie their fame and felicity, and such as suspect their ability and candor, may be silenced and disappointed in their detractions and expectations."*

## Chapter X.

*Spots on the Sun—Essay on Floating Bodies—Scheiner—Change in Saturn.*

Galileo did not indulge the curiosity of his Roman friends by exhibiting only the wonders already mentioned, which now began to lose the gloss of novelty, but disclosed a new discovery, which appeared still more extraordinary, and, to the opposite faction, more hateful than anything of which he had yet spoken. This was the discovery, which he first made in the month of March, 1611, of dark spots on the body of the sun. A curious fact, and one which well serves to illustrate Galileo's superiority in seeing things simply as they are, is, that these spots had been observed and recorded centuries before he existed, but, for want of careful observation, their true nature had been constantly misapprehended. One of the most celebrated occasions was in the year 807 of our era, in which a dark spot is mentioned as visible on the face of the sun during seven or eight days. It was then supposed to be Mercury†. Kepler, whose astronomical knowledge would not suffer him to overlook that it was impossible that Mercury could remain so long in conjunction with the sun, preferred to solve the difficulty by supposing that, in Aimoin's original account, the expression was not *octo dies* (eight days), but *octoties*—a barbarous word, which he supposed to have been written for *octies* (eight times); and that the other accounts (in which the number of days mentioned is different) copying loosely from the first, had both mistaken the word, and misquoted the time which they thought they found mentioned there. It is impossible to look on this explanation as satisfactory, but Kepler, who at that time did not dream of spots on the sun, was perfectly contented with it. In 1609, he himself observed upon the sun a black spot, which he in like manner mistook for Mercury, and unluckily the day, being cloudy, did

* Nelli Saggio di Storia Literaria Fiorentina, Lucca, 1759.

* Salusbury's Math. Coll. vol. ii. London, 1664.

† Aimoini Hist. Francorum. Parisiis, 1567.

not allow him to contemplate it sufficiently long to discover his error, which the slowness of its apparent motion would soon have pointed out.* He hastened to publish his supposed observation, but no sooner was Galileo's discovery of the solar spots announced, than he, with that candour which as much as his flighty disposition certainly characterized him at all times, retracted his former opinion, and owned his belief that he had been mistaken. In fact it is known from the more accurate theory which we now possess of Mercury's motions, that it did not pass over the sun's face at the time when Kepler thought he perceived it there.

Galileo's observations were in their consequences to him particularly unfortunate, as in the course of the controversy in which they engaged him, he first became personally embroiled with the powerful party, whose prevailing influence was one of the chief causes of his subsequent misfortunes. Before we enter upon that discussion, it will be proper to mention another famous treatise which Galileo produced soon after his return from Rome to Florence, in 1612. This is, his Discourse on Floating Bodies, which restored Archimedes' theory of hydrostatics, and has, of course, met with the opposition which few of Galileo's works failed to encounter. In the commencement, he thought it necessary to apologize for writing on a subject so different from that which chiefly occupied the public attention, and declared that he had been too closely occupied in calculating the periods of the revolutions of Jupiter's satellites to permit him to publish anything earlier. These periods he had succeeded in determining during the preceding year, whilst at Rome, and he now announced them to complete their circuits, the first in about 1 day, 18½ hours; the second in 3 days, 13 hours, 20 minutes; the third in 7 days, 4 hours; and the outermost in 16 days, 18 hours. All these numbers he gave merely as approximately true, and promised to continue his observations, for the purpose of correcting the results. He then adds an announcement of his recent discovery of the solar spots, "which, as they change their situation, offer a strong argument, either that the sun revolves on itself, or that, perhaps, other stars, like Venus and Mercury, revolve about it, invisible at all other times, on account of the small distance to which they are removed from him." To this he afterwards subjoined, that, by continued observation, he had satisfied himself that these solar spots were in actual contact with the surface of the sun, where they are continually appearing and disappearing; that their figures were very irregular, some being very dark, and others not so black; that one would often divide into three or four, and, at other times, two, three, or more would unite into one; besides which, that they had all a common and regular motion, with which they revolved round with the sun, which turned upon its axis in about the time of a lunar month.

Having by these prefatory observations assuaged the public thirst for astronomical novelties, he ventures to introduce the principal subject of the treatise above mentioned. The question of floating bridges had been discussed at one of the scientific parties, assembled at the house of Galileo's friend Salviati, and the general opinion of the company appearing to be that the floating or sinking of a body depended principally upon its shape, Galileo undertook to convince them of their error. If he had not preferred more direct arguments, he might merely have told them that in this instance they were opposed to their favourite Aristotle, whose words are very unequivocal on the point in dispute. "Form is not the cause why a body moves downwards rather than upwards, but it does affect the swiftness with which it moves;"* which is exactly the distinction which those who called themselves Aristotelians were unable to perceive, and to which the opinions of Aristotle himself were not always true. Galileo states the discussion to have immediately arisen from the assertion of some one in the company, that condensation is the effect of cold, and ice was mentioned as an instance. On this, Galileo observed, that ice is rather water rarefied than condensed, the proof of which is, that ice always floats upon water.† It was replied, that the reason of this phenomenon was, not the superior lightness of the ice, but its incapacity, owing to its flat shape, to penetrate and overcome the resistance of the water. Galileo denied this, and asserted that ice of any shape would float upon water, and that, if a

* Mercurius in sole visus. 1609.

* De Cœlo. lib. 4.

† For a discussion of this singular phenomenon, see Treatise on Heat, p. 12; and it is worth while to remark in passing, what an admirable instance it affords of Galileo's instantaneous abandonment of a theory so soon as it became inconsistent with experiment.

flat piece of ice were forcibly taken to the bottom, it would of itself rise again to the surface. Upon this assertion it appears that the conversation became so clamorous, that Galileo thought it pertinent to commence his Essay with the following observation on the advantage of delivering scientific opinions in writing, " because in conversational arguments, either one or other party, or perhaps both, are apt to get overwarm, and to speak overloud, and either do not suffer each other to be heard, or else, transported with the obstinacy of not yielding, wander far away from the original proposition, and confound both themselves and their auditors with the novelty and variety of their assertions." After this gentle rebuke he proceeds with his argument, in which he takes occasion to state the famous hydrostatical paradox, of which the earliest notice is to be found in Stevin's works, a contemporary Flemish engineer, and refers it to a principle on which we shall enlarge in another chapter. He then explains the true theory of buoyancy, and refutes the false reasoning on which the contrary opinions were founded, with a variety of experiments.

The whole value and interest of experimental processes generally depends on a variety of minute circumstances, the detail of which would be particularly unsuited to a sketch like the present one. For those who are desirous of becoming more familiar with Galileo's mode of conducting an argument, it is fortunate that such a series of experiments exists as that contained in this essay; experiments which, from their simplicity, admit of being for the most part concisely enumerated, and at the same time possess so much intrinsic beauty and characteristic power of forcing conviction. They also present an admirable specimen of the talent for which Galileo was so deservedly famous, of inventing ingenious arguments in favour of his adversaries' absurd opinions before he condescended to crush them, shewing that nothing but his love of truth stood in the way of his being a more subtle sophist than any amongst them. In addition to these reasons for giving these experiments somewhat in detail, is the fact that all explanation of one of the principal phenomena to which they allude is omitted in many more modern treatises on Hydrostatics; and in some it is referred precisely to the false doctrines here confuted.

The marrow of the dispute is included in Galileo's assertion, that "The diversity of figure given to any solid cannot be in any way the cause of its absolutely sinking or floating; so that if a solid, when formed for example into a spherical figure, sinks or floats in the water, the same body will sink or float in the same water, when put into any other form. The breadth of the figure may indeed retard its velocity, as well of ascent as descent, and more and more according as the said figure is reduced to a greater breadth and thinness; but that it may be reduced to such a form as absolutely to put an end to its motion in the same fluid, I hold to be impossible. In this I have met with great contradictors who, producing some experiments, and in particular a thin board of ebony, and a ball of the same wood, and shewing that the ball in water sinks to the bottom*, and that the board if put lightly on the surface floats, have held and confirmed themselves in their opinion with the authority of Aristotle, that the cause of that rest is the breadth of the figure, unable by its small weight to pierce and penetrate the resistance of the water's thickness, which is readily overcome by the other spherical figure."—For the purpose of these experiments, Galileo recommends a substance such as wax, which may be easily moulded into any shape, and with which, by the addition of a few filings of lead, a substance may be readily made of any required specific gravity. He then declares that if a ball of wax of the size of an orange, or bigger, be made in this manner heavy enough to sink to the bottom, but so lightly that if we take from it only one grain of lead it returns to the top; and if the same wax be afterwards moulded into a broad and thin cake, or into any other figure, regular or irregular, the addition of the same grain of lead will always make it sink, and it will again rise when we remove the lead from it.—" But methinks I hear some of the adversaries raise a doubt upon my produced experiment: and, first, they offer to my consideration that the figure, as a figure simply, and disjunct from the matter, works no effect, but requires to be conjoined with the matter; and, moreover, not with every matter, but with those only wherewith it may be able to execute the desired operation. Just as we see by experience

* Ebony is one of the few woods heavier than water. See Treatise on Hydrostatics.

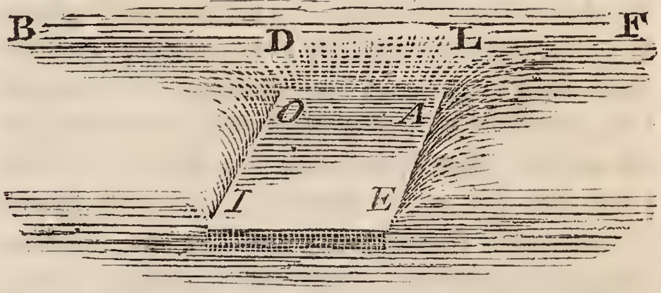
that an acute and sharp angle is more apt to cut than an obtuse; yet always provided that both one and the other are joined with a matter fit to cut, as for instance, steel. Therefore a knife with a fine and sharp edge cuts bread or wood with much ease, which it will not do if the edge be blunt and thick; but if, instead of steel, any one will take wax and mould it into a knife, undoubtedly he will never learn the effects of sharp and blunt edges, because neither of them will cut; the wax being unable, by reason of its flexibility, to overcome the hardness of the wood and bread. And therefore, applying the like discourse to our argument, they say that the difference of figure will shew different effects with regard to floating and sinking, but not conjoined with any kind of matter, but only with those matters which by their weight are able to overcome the viscosity of the water (like the ebony which they have selected); and he that will select cork or other light wood to form solids of different figures, would in vain seek to find out what operation figure has in sinking or floating, because all would swim, and that not through any property of this or that figure, but through the debility of the matter."

"When I begin to examine one by one all the particulars here produced, I allow not only that figures, simply as such, do not operate in natural things, but also that they are never separated from the corporeal substance, nor have I ever alleged them to be stript of sensible matter: and also I freely admit, that in our endeavours to examine the diversity of accidents which depend upon the variety of figures, it is necessary to apply them to matters which obstruct not the various operations of those various figures. I admit and grant that I should do very ill if I were to try the influence of a sharp edge with a knife of wax, applying it to cut an oak, because no sharpness in wax is able to cut that very hard wood. But yet, such an experiment of this knife would not be beside the purpose to cut curded milk, or other very yielding matter; nay, in such matters, the wax is more convenient than steel for finding the difference depending on the acuteness of the angles, because milk is cut indifferently with a razor, or a blunt knife. We must therefore have regard not only to the hardness, solidity, or weight of the bodies which, under different figures, are to divide some matters asunder; but also, on the other hand, to the resistance of the matter to be penetrated. And, since I have chosen a matter which does penetrate the resistance of the water, and in all figures descends to the bottom, my antagonists can charge me with no defect; nor (to revert to their illustration) have I attempted to test the efficacy of acuteness by cutting with matters unable to cut. I subjoin withal, that all caution, distinction, and election of matter would be superfluous and unnecessary, if the body to be cut should not at all resist the cutting: if the knife were to be used in cutting a mist, or smoke, one of paper would serve the purpose as well as one of Damascus steel; and I assert that this is the case with water, and that there is not any solid of such lightness or of such a figure, that being put on the water it will not divide and penetrate its thickness; and if you will examine more carefully your thin boards of wood, you will see that they have part of their thickness under water; and, moreover, you will see that the shavings of ebony, stone, or metal, when they float, have not only thus broken the continuity of the water, but are with all their thickness under the surface of it; and that more and more, according as the floating substance is heavier, so that a thin floating plate of lead will be lower than the surface of the surrounding water by at least twelve times the thickness of the plate, and gold will dive below the level of the water almost twenty times the thickness of the plate, as I shall shew presently."

In order to illustrate more clearly the non-resistance of water to penetration, Galileo then directs a cone to be made of wood or wax, and asserts that when it floats, either with its base or point in the water, the solid content of the part immersed will be the same, although the point is, by its shape, better adapted to overcome the resistance of the water to division, if that were the cause of the buoyancy. Or the experiment may be varied by tempering the wax with filings of lead, till it sinks in the water, when it will be found that in any figure the same cork must be added to it to raise it to the surface.—"This silences not my antagonists; but they say that all the discourse hitherto made by me imports little to them, and that it serves their turn, that they have demonstrated in one instance, and in such manner and figure as pleases them best, namely, in a board and a ball of ebony,

that one, when put into the water, sinks to the bottom, and that the other stays to swim at the top; and the matter being the same, and the two bodies differing in nothing but in figure, they affirm that with all perspicuity they have demonstrated and sensibly manifested what they undertook. Nevertheless I believe, and think I can prove that this very experiment proves nothing against my theory. And first it is false that the ball sinks, and the board not; for the board will sink too, if you do to both the figures as the words of our question require; that is, if you put them both *in* the water; for to be in the water implies to be placed in the water, and by Aristotle's own definition of place, to be placed imports to be environed by the surface of the ambient body; but when my antagonists shew the floating board of ebony, they put it not into the water, but upon the water; where, being detained by a certain impediment (of which more anon) it is surrounded, partly with water, partly with air, which is contrary to our agreement, for that was that the bodies should be in the water, and not part in the water, part in the air. I will not omit another reason, founded also upon experience, and, if I deceive not myself, conclusive against the notion that figure, and the resistance of the water to penetration have anything to do with the buoyancy of bodies. Choose a piece of wood or other matter, as for instance walnut-wood, of which a ball rises from the bottom of the water to the surface more slowly than a ball of ebony of the same size sinks, so that clearly the ball of ebony divides the water more readily in sinking than does the walnut in rising. Then take a board of walnut-tree equal to and like the floating ebony one of my antagonists; and if it be true that this latter floats by reason of the figure being unable to penetrate the water, the other of walnut-tree, without all question, if thrust to the bottom ought to stay there, as having the same impeding figure, and being less apt to overcome the said resistance of the water. But if we find by experience that not only the thin board, but every other figure of the same walnut-tree will return to float, as unquestionably we shall, then I must desire my opponents to forbear to attribute the floating of the ebony to the figure of the board, since the resistance of the water is the same in rising as in sinking, and the force of ascension of the walnut-tree is less than the ebony's force for going to the bottom."

"Now, let us return to the thin plate of gold or silver, or the thin board of ebony, and let us lay it lightly upon the water, so that it may stay there without sinking, and carefully observe the effect. It will appear clearly that the plates are a considerable matter lower than the surface of the water which rises up, and makes a kind of rampart round them on every side, in the manner shewn in the annexed figure, in which B D L F repre-




sents the surface of the water, and A E I O the surface of the plate. But if it have already penetrated and overcome the continuity of the water, and is of its own nature heavier than the water, why does it not continue to sink, but stop and suspend itself in that little dimple that its weight has made in the water? My answer is, because in sinking till its surface is below the water which rises up in a bank round it, it draws after and carries along with it the air above it, so that that which in this case descends and is placed in the water, is not only the board of ebony or plate of iron, but a compound of ebony and air, from which composition results a solid no longer specifically heavier than the water, as was the ebony or gold alone. But, Gentlemen, we want the same matter; you are to alter nothing but the shape, and therefore have the goodness to remove this air, which may be done simply by washing the upper surface of the board, for the water having once got between the board and air will run together, and the ebony will go to the bottom; and if it does not, you have won the day. But methinks I hear some of my antagonists cunningly opposing this, and telling me that they will not on any account allow their board to be wetted, because the weight of the water so added, by making it heavier than it was before, draws it to the bottom, and that the addition of new weight is contrary to our agreement, which was that the matter should be the same."

"To this I answer first, that nobody can suppose bodies to be put into the water without their being wet, nor do I

wish to do more to the board than you may do to the ball. Moreover, it is not true that the board sinks on account of the weight of the water added in the washing; for I will put ten or twenty drops on the floating board, and so long as they stand separate it shall not sink; but if the board be taken out, and all that water wiped off, and the whole surface bathed with one single drop, and put it again upon the water, there is no question but it will sink, the other water running to cover it, being no longer hindered by the air. In the next place it is altogether false that water can in any way increase the weight of bodies immersed in it, for water has no weight in water, since it does not sink. Now, just as he who should say that brass by its own nature sinks, but that when formed into the shape of a kettle, it acquires from that figure a virtue of lying in the water without sinking, would say what is false, because that is not purely brass which then is put into the water, but a compound of brass and air; so is it neither more nor less false, that a thin plate of brass or ebony swims by virtue of its dilated and broad figure. Also I cannot omit to tell my opponents, that this conceit of refusing to bathe the surface of the board, might beget an opinion in a third person of a poverty of arguments on their side, especially as the conversation began about flakes of ice, in which it would be simple to require that the surfaces should be kept dry; not to mention that such pieces of ice, whether wet or dry, always float, and as my antagonists say, because of their shape."

"Some may wonder that I affirm this power to be in the air of keeping the plate of brass or silver above water, as if in a certain sense I would attribute to the air a kind of magnetic virtue for sustaining heavy bodies with which it is in contact. To satisfy all these doubts, I have contrived the following experiment to demonstrate how truly the air does support these solids; for I have found, when one of these bodies which floats when placed lightly on the water, is thoroughly bathed and sunk to the bottom, that by carrying down to it a little air without otherwise touching it in the least, I am able to raise and carry it back to the top, where it floats as before. To this effect I take a ball of wax, and with a little lead make it just heavy enough to sink very slowly to the bottom, taking care that its surface be quite smooth and even. This, if put gently into the water, submerges almost entirely, there remaining visible only a little of the very top, which, so long as it is joined to the air, keeps the ball afloat; but if we take away the contact of the air by wetting this top, the ball sinks to the bottom, and remains there. Now to make it return to the surface by virtue of the air which before sustained it, thrust into the water a glass, with the mouth downwards, which will carry with it the air it contains; and move this down towards the ball, until you see by the transparency of the glass that the air has reached the top of it; then gently draw the glass upwards, and you will see the ball rise, and afterwards stay on the top of the water, if you carefully part the glass and water without too much disturbing it*. There is therefore a certain affinity between the air and other bodies, which holds them united, so that they separate not without a kind of violence, just as between water and other bodies; for in drawing them wholly out of the water, we see the water follow them, and rise sensibly above the level before it quits them." Having established this principle by this exceedingly ingenious and convincing experiment, Galileo proceeds to shew from it what must be the dimensions of a plate of any substance which will float as the wax does, assuming in each case that we know the greatest height at which the rampart of water will stand round it. In like manner he shows that a pyramidal or conical figure may be made of any substance, such that by help of the air, it shall rest upon the water without wetting more than its base; and that we may so form a cone of any substance that it shall float if placed gently on the surface, with its point downwards, whereas no care or pains will enable it to float with its base downwards, owing to the different proportions of air which in the two positions remain connected with it. With this parting blow at his antagonist's theory we close our extracts from this admirable essay.

The first elements of the theory of running waters were reserved for Castelli, an intimate friend and pupil of Galileo. On the present occasion, Castelli appeared as the ostensible author of a de-

* In making this very beautiful experiment, it is best to keep the glass a few seconds in the water, to give time for the surface of the ball to dry. It will also succeed with a light needle, if carefully conducted.

fence against the attacks made by Vincenzio di Grazia and by Lodovico delle Columbe (the author of the crystalline composition of the moon) on the obnoxious theory. After destroying all the objections which they produced, the writer tauntingly bids them remember, that he was merely Galileo's pupil, and consider how much more effectually Galileo himself would have confuted them, had he thought it worth while. It was not known till several years after his death, that this Essay was in fact written by Galileo himself.*

These compositions merely occupied the leisure time which he could withhold from the controversy on the solar spots to which we have already alluded. A German Jesuit named Christopher Scheiner, who was professor of mathematics at Ingolstadt, in imitation of Galileo had commenced a series of observations on them, but adopted the theory which, as we have seen, Galileo had examined and rejected, that these spots are planets circulating at some distance from the body of the sun. The same opinion had been taken up by a French astronomer, who in honour of the reigning family called them Borbonian stars. Scheiner promulgated his notions in three letters, addressed to their common friend Welser, under the quaint signature of "*Apelles latens post tabulam.*" Galileo replied to Scheiner's letters by three others, also addressed to Welser, and although the dispute was carried on amid mutual professions of respect and esteem, it laid the foundation of the total estrangement which afterwards took place between the two authors. Galileo's part of this controversy was published at Rome by the Lyncean Academy in 1613. To the last of his letters, written in December, 1612, is annexed a table of the expected positions of Jupiter's satellites during the months of March and April of the following year, which, imperfect as it necessarily was, cannot be looked upon without the greatest interest.

In the same letter it is mentioned that Saturn presented a novel appearance, which, for an instant, almost induced Galileo to mistrust the accuracy of his earlier observations. The lateral appendages of this planet had disappeared, and the accompanying extract will show the uneasiness which Galileo could not conceal at the sight of this phenomenon, although it is admirable to see the contempt with which, even in that trying moment, he expresses his consciousness that his adversaries were unworthy of the triumph they appeared on the point of celebrating.—"Looking on Saturn within these few days, I found it solitary, without the assistance of its accustomed stars, and in short, perfectly round and defined like Jupiter, and such it still remains. Now what can be said of so strange a metamorphosis? are perhaps the two smaller stars consumed, like the spots on the sun? have they suddenly vanished and fled? or has Saturn devoured his own children? or was the appearance indeed fraud and illusion, with which the glasses have for so long a time mocked me, and so many others who have often observed with me. Now perhaps the time is come to revive the withering hopes of those, who, guided by more profound contemplations, have fathomed all the fallacies of the new observations and recognised their impossibility! I cannot resolve what to say in a chance so strange, so new, and so unexpected; the shortness of the time, the unexampled occurrence, the weakness of my intellect, and the terror of being mistaken, have greatly confounded me." These first expressions of alarm are not to be wondered at; however, he soon recovered courage, and ventured to foretel the periods at which the lateral stars would again show themselves, protesting at the same time, that he was in no respect to be understood as classing this prediction among the results which depend on certain principles and sound conclusions, but merely on some conjectures which appeared to him probable. From one of the Dialogues on the System, we learn that this conjecture was, that Saturn might revolve upon his axis, but the period which he assumed is very different from the true one, as might be expected from its being intended to account for a phenomenon of which Galileo had not rightly apprehended the character.

He closed this letter with renewed professions of courtesy and friendship towards Apelles, enjoining Welser not to communicate it without adding his excuses, if he should be thought to dissent too violently from his antagonist's ideas, declaring that his only object was the discovery of truth, and that he had freely exposed his own opinion, which he was still ready to change, so soon as his errors should be made manifest to him;

* Nelli, Saggio di Stor. Liter. Fiorent.

and that he would consider himself under special obligation to any one who would be kind enough to discover and correct them. These letters were written from the villa of his friend Salviati at Selve near Florence, where he passed great part of his time, particularly during his frequent indispositions, conceiving that the air of Florence was prejudicial to him. Cesi was very anxious for their appearance, since they were (in his own words) so hard a morsel for the teeth of the Peripatetics, and he exhorted Galileo, in the name of the society, "to continue to give them, and the nameless Jesuit, something to gnaw."

## Chapter XI.

*Letter to Christina, Arch-Duchess of Tuscany—Caccini—Galileo revisits Rome—Inchoffer—Problem of Longitudes.*

The uncompromising boldness with which Galileo published and supported his opinions, with little regard to the power and authority of those who advocated the contrary doctrines, had raised against him a host of enemies, who each had objections to him peculiar to themselves, but who now began to perceive the policy of uniting their strength in the common cause, to crush if possible so dangerous an innovator. All the professors of the old opinions, who suddenly found the knowledge on which their reputation was founded struck from under them, and who could not reconcile themselves to their new situation of learners, were united against him; and to this powerful cabal was now added the still greater influence of the jesuits and pseudo-theological party, who fancied they saw in the spirit of Galileo's writings the same inquisitive temper which they had already found so inconvenient in Luther and his adherents. The alarm became greater every day, inasmuch as Galileo had succeeded in training round him a numerous band of followers who all appeared imbued with the same dangerous spirit of innovation, and his favourite scholars were successful candidates for professorships in many of the most celebrated universities of Italy.

At the close of 1613, Galileo addressed a letter to his pupil, the Abbé Castelli, in which he endeavoured to shew that there is as much difficulty in reconciling the Ptolemaic as the Copernican system of the world with the astronomical expressions contained in the Scriptures, and asserted, that the object of the Scriptures not being to teach astronomy, such expressions are there used as would be intelligible and conformable to the vulgar belief, without regard to the true structure of the universe; which argument he afterwards amplified in a letter addressed to Christina, Grand Duchess of Tuscany, the mother of his patron Cosmo. He discourses on this subject with the moderation and good sense which so peculiarly characterized him. "I am," says he, "inclined to believe, that the intention of the sacred Scriptures is to give to mankind the information necessary for their salvation, and which, surpassing all human knowledge, can by no other means be accredited than by the mouth of the Holy Spirit. But I do not hold it necessary to believe, that the same God who has endowed us with senses, with speech, and intellect, intended that we should neglect the use of these, and seek by other means for knowledge which they are sufficient to procure us; especially in a science like astronomy, of which so little notice is taken in the Scriptures, that none of the planets, except the sun and moon, and, once or twice only, Venus under the name of Lucifer, are so much as named there. This therefore being granted, methinks that in the discussion of natural problems we ought not to begin at the authority of texts of Scripture, but at sensible experiments and necessary demonstrations: for, from the divine word, the sacred Scripture and nature did both alike proceed, and I conceive that, concerning natural effects, that which either sensible experience sets before our eyes, or necessary demonstrations do prove unto us, ought not upon any account to be called into question, much less condemned, upon the testimony of Scriptural texts, which may under their words couch senses seemingly contrary thereto.

"Again, to command the very professors of astronomy that they of themselves see to the confuting of their own observations and demonstrations, is to enjoin a thing beyond all possibility of doing; for it is not only to command them not to see that which they do see, and not to understand that which they do understand, but it is to order them to seek for and to find the contrary of that which they happen to meet with. I would entreat these wise and prudent fathers, that they would with all diligence consi-

der the difference that is between opinionative and demonstrative doctrines: to the end that well weighing in their minds with what force necessary inferences urge us, they might the better assure themselves that it is not in the power of the professors of demonstrative sciences to change their opinions at pleasure, and adopt first one side and then another; and that there is a great difference between commanding a mathematician or a philosopher, and the disposing of a lawyer or a merchant; and that the demonstrated conclusions touching the things of nature and of the heavens cannot be changed with the same facility as the opinions are touching what is lawful or not in a contract, bargain, or bill of exchange. Therefore, first let these men apply themselves to examine the arguments of Copernicus and others, and leave the condemning of them as erroneous and heretical to whom it belongeth; yet let them not hope to find such rash and precipitous determinations in the wary and holy fathers, or in the absolute wisdom of him who cannot err, as those into which they suffer themselves to be hurried by some particular affection or interest of their own. In these and such other positions, which are not directly articles of faith, certainly no man doubts but His Holiness hath always an absolute power of admitting or condemning them, but it is not in the power of any creature to make them to be true or false, otherwise than of their own nature, and in fact they are." We have been more particular in extracting these passages, because it has been advanced by a writer of high reputation, that the treatment which Galileo subsequently experienced was solely in consequence of his persisting in the endeavour to prove that the Scriptures were reconcileable with the Copernican theory*, whereas we see here distinctly that, for the reasons we have briefly stated, he regarded this as a matter altogether indifferent and beside the question.

Galileo had not entered upon this discussion till driven to it by a most indecent attack, made on him from the pulpit, by a Dominican friar named Caccini, who thought it not unbecoming his habit or religion to play upon the words of a Scriptural text for the purpose of attacking Galileo and his partisans with more personality*. Galileo complained formally of Caccini's conduct to Luigi Maraffi the general of the Dominicans, who apologised amply to him, adding that he himself was to be pitied for finding himself implicated in all the brutal conduct of thirty or forty thousand monks.

In the mean time, the inquisitors at Rome had taken the alarm, and were already, in 1615, busily employed in collecting evidence against Galileo. Lorini, a brother Dominican of Caccini, had given them notice of the letter to Castelli of which we have spoken, and the utmost address was employed to get the original into their hands, which attempt however was frustrated, as Castelli had returned it to the writer. Caccini was sent for to Rome, settled there with the title of Master of the Convent of St. Mary of Minerva, and employed to put the depositions against Galileo into order. Galileo was not at this time fully aware of the machinations against him, but suspecting something of their nature, he solicited and obtained permission from Cosmo, towards the end of 1615, to make a journey to Rome, for the purpose of more directly confronting his enemies in that city. There was a rumour at the time that this visit was not voluntary, but that Galileo had been cited to appear at Rome. A contemporary declares that he heard this from Galileo himself: at any rate, in a letter which Galileo shortly afterwards wrote to Picchena, the Grand Duke's secretary, he expresses himself well satisfied with the results of this step, whether forced or not, and Querenghi thus describes to the Cardinal d'Este the public effect of his appearance: "Your Eminence would be delighted with Galileo if you heard him holding forth, as he often does, in the midst of fifteen or twenty, all violently attacking him, sometimes in one house, sometimes in another. But he is armed after such fashion that he laughs all of them to scorn—and even if the novelty of his opinions prevents entire persuasion, at least he convicts of emptiness most of the arguments with which his adversaries endeavour to overwhelm him. He was particularly admi-

* Ce philosophe (Galilée) ne fut point persecuté comme bon astronome, mais comme mauvais théologien. C'est son entêtement à vouloir concilier la Bible avec Copernic qui lui donna des juges. Mais vingt auteurs, surtout parmi les protestans, ont écrit que Galilée fut persecuté et imprisonné pour avoir soutenu que la terre tourne autour du soleil, que ce système a été condanné par l'inquisition comme faux, erroné et contraire à la Bible, &c.—Bergier, Encyclopédie Méthodique, Paris, 1790, Art. SCIENCES HUMAINES.

* Viri Galilæi, quid statis adspicientes in cœlum, *Acts* I. II.

rable on Monday last, in the house of Signor Frederico Ghisilieri; and what especially pleased me was, that before replying to the contrary arguments, he amplified and enforced them with new grounds of great plausibility, so as to leave his adversaries in a more ridiculous plight when he afterwards overturned them all."

Among the malicious stories which were put into circulation, it had been said, that the Grand Duke had withdrawn his favour, which emboldened many, who would not otherwise have ventured on such open opposition, to declare against Galileo. His appearance at Rome, where he was lodged in the palace of Cosmo's ambassador, and whence he kept up a close correspondence with the Grand Duke's family, put an immediate stop to rumours of this kind. In little more than a month he was apparently triumphant, so far as regarded himself; but the question now began to be agitated whether the whole system of Copernicus ought not to be condemned as impious and heretical. Galileo again writes to Picchena, "so far as concerns the clearing of my own character, I might return home immediately; but although this new question regards me no more than all those who for the last eighty years have supported these opinions both in public and private, yet, as perhaps I may be of some assistance in that part of the discussion which depends on the knowledge of truths ascertained by means of the sciences which I profess, I, as a zealous and Catholic Christian, neither can nor ought to withhold that assistance which my knowledge affords; and this business keeps me sufficiently employed." De Lambre, whose readiness to depreciate Galileo's merit we have already noticed and lamented, sneeringly and ungratefully remarks on this part of his life, that "it was scarcely worth while to compromise his tranquillity and reputation, in order to become the champion of a truth which could not fail every day to acquire new partisans by the natural effect of the progress of enlightened opinions." We need not stop to consider what the natural effects might have been if none had at any time been found who thought their tranquillity worthily offered up in such a cause.

It has been hinted by several, and is indeed probable, that Galileo's stay at Rome rather injured the cause (so far as provoking the inquisitorial censures could injure it) which it was his earnest desire to serve, for we cannot often enough repeat the assertion, that it was not the doctrine itself, so much as the free, unyielding manner in which it was supported, which was originally obnoxious. Copernicus had been allowed to dedicate his great work to Pope Paul III., and from the time of its first appearance under that sanction in 1543, to the year 1616, of which we are now writing, this theory was left in the hands of mathematicians and philosophers, who alternately attacked and defended it without receiving either support or molestation from ecclesiastical decrees. But this was henceforward no longer the case, and a higher degree of importance was given to the controversy from the religious heresies which were asserted to be involved in the new opinions. We have already given specimens of the so called philosophical arguments brought against Copernicus; and the reader may be curious to know the form of the theological ones. Those which we select are taken from a work, which indeed did not come forth till the time of Galileo's third visit to Rome, but it is relative to the matter now before us, as it professed to be, and its author's party affected to consider it, a complete refutation of the letters to Castelli and the Archduchess Christina *.

It was the work of a Jesuit, Melchior Inchoffer, and it was greatly extolled by his companions, "as differing so entirely from the pruriency of the Pythagorean writings." He quotes with approbation an author who, first referring to the first verse of Genesis for an argument that the earth was not created till after the heavens, observes that the whole question is thus reduced to the examination of this purely geometrical difficulty—In the formation of a sphere, does the centre or circumference first come into existence? If the latter (which we presume Melchior's friend found good reason for deciding upon), the consequence is inevitable. The earth is in the centre of the universe.

It may not be unprofitable to contrast the extracts which we have given from Galileo's letters on the same subject with the following passage, which appears one of the most subtle and argumen-

* Tractatus Syllepticus. Romæ, 1633. The title-page of this remarkable production is decorated with an emblematical figure, representing the earth included in a triangle; and in the three corners, grasping the globe with their fore feet, are placed three bees, the arms of Pope Urban VIII. who condemned Galileo and his writings. The motto is "*His fixa quiescit*," "Fixed by these it is at rest."

tative which is to be found in Melchior's book. He *professes* to be enumerating and refuting the principal arguments which the Copernicans adduced for the motion of the earth. "Fifth argument. Hell is in the centre of the earth, and in it is a fire tormenting the damned; therefore it is absolutely necessary that the earth is moveable. The antecedent is plain." (Inchoffer then quotes a number of texts of Scripture on which, according to him, the Copernicans relied in proof of this part of the argument.) "The consequent is proved: because fire is the cause of motion, for which reason Pythagoras, who, as Aristotle reports, puts the place of punishment in the centre, perceived that the earth is animate and endowed with action. I answer, even allowing that hell is in the centre of the earth, and a fire in it, I deny the consequence: and for proof I say, if the argument is worth any thing, it proves also that lime-kilns, ovens, and fire-grates are animated and spontaneously moveable. I say, *even allowing* that hell is in the centre of the earth: for Gregory, book 4, dial. chap. 42, says, that he dare not decide rashly on this matter, although he thinks more probable the opinion of those who say that it is under the earth. St. Thomas, in Opusc. 10, art. 31, says: Where hell is, whether in the centre of the earth or at the surface, does not in my opinion, relate to any article of faith; and it is superfluous to be solicitous about such things, either in asserting or denying them. And Opusc. 11, art. 24, he says, that it seems to him that nothing should be rashly asserted on this matter, particularly as Augustin thinks that nobody knows where it is; but I do not, says he, think that it is in the centre of the earth. I should be loth, however, that it should be hence inferred by *some people* that hell is in the earth, that we are ignorant where hell is, and therefore that the situation of the earth is also unknown, and, in conclusion, that it cannot therefore be the centre of the universe. The argument shall be retorted in another fashion: for if the place of the earth is unknown, it cannot be said to be in a great circle, so as to be moved round the sun. Finally I say that in fact it is known where the earth is."

It is not impossible that some persons adopted the Copernican theory, from an affectation of singularity and freethinking, without being able to give very sound reasons for their change of opinion, of whom we have an instance in Origanus, the astrological instructor of Wallenstein's famous attendant Seni, who edited his work. His arguments in favour of the earth's motion are quite on a level with those advanced on the opposite side in favour of its immobility; but we have not found any traces whatever of such absurdities as these having been urged by any of the leaders of that party, and it is far more probable that they are the creatures of Melchior's own imagination. At any rate it is worth remarking how completely he disregards the real physical arguments, which he ought, in justice to his cause, to have attempted to controvert. His book was aimed at Galileo and his adherents, and it is scarcely possible that he could seriously persuade himself that he was stating and overturning arguments similar to those by which Galileo had made so many converts to the opinions of Copernicus. Whatever may be our judgment of his candour, we may at least feel assured that if this had indeed been a fair specimen of Galileo's philosophy, he might to the end of his life have taught that the earth moved round the sun, or if his fancy led him to a different hypothesis, he might like the Abbé Baliani have sent the earth spinning round the stationary moon, and like him have remained unmolested by pontifical censures. It is true that Baliani owned his opinion to be much shaken, on observing it to be opposed to the decree of those in whose hands was placed the power of judging articles of faith. But Galileo's uncompromising spirit of analytical investigation, and the sober but invincible force of reasoning with which he beat down every sophism opposed to him, the instruments with which he worked, were more odious than the work itself, and the condemnation which he had vainly hoped to avert was probably on his very account accelerated.

Galileo, according to his own story, had in March 1616 a most gracious audience of the pope, Paul V., which lasted for nearly an hour, at the end of which his holiness assured him, that the Congregation were no longer in a humour to listen lightly to calumnies against him, and that so long as he occupied the papal chair, Galileo might think himself out of all danger. But nevertheless he was not allowed to return home, without receiving formal notice not to teach the opinions of Co-

pernicus, that the sun is in the centre of the system, and that the earth moves about it, from that time forward, in any manner. That these were the literal orders given to Galileo will be presently proved from the recital of them in the famous decree against him, seventeen years later. For the present, his letters which we have mentioned, as well as one of a similar tendency by Foscarini, a Carmelite friar—a commentary on the book of Joshua by a Spaniard named Diego Zuniga—Kepler's Epitome of the Copernican Theory—and Copernicus's own work, were inserted in the list of forbidden books, nor was it till four years afterwards, in 1620, that, on reconsideration, Copernicus was allowed to be read with certain omissions and alterations then decided upon.

Galileo quitted Rome scarcely able to conceal his contempt and indignation. Two years afterwards this spirit had but little subsided, for in forwarding to the Archduke Leopold his Theory of the Tides, he accompanied it with the following remarks:—"This theory occurred to me when in Rome, whilst the theologians were debating on the prohibition of Copernicus's book, and of the opinion maintained in it of the motion of the earth, which I at that time believed; until it pleased those gentlemen to suspend the book, and declare the opinion false and repugnant to the Holy Scriptures. Now, as I know how well it becomes me to obey and believe the decisions of my superiors, which proceed out of more profound knowledge than the weakness of my intellect can attain to, this theory which I send you, which is founded on the motion of the earth, I now look upon as a fiction and a dream, and beg your highness to receive it as such. But, as poets often learn to prize the creations of their fancy, so, in like manner, do I set some value on this absurdity of mine. It is true that when I sketched this little work, I did hope that Copernicus would not, after 80 years, be convicted of error, and I had intended to develope and amplify it farther, but a voice from heaven suddenly awakened me, and at once annihilated all my confused and entangled fancies."

It might have been predicted, from the tone of this letter alone, that it would not be long before Galileo would again bring himself under the censuring notice of the astronomical hierarchy, and indeed he had, so early as 1610, collected some of the materials for the work which caused the final explosion, and on which he now employed himself with as little intermission as the weak state of his health permitted.

He had been before this time engaged in a correspondence with the court of Spain, on the method of observing longitudes at sea, for the solution of which important problem Philip III. had offered a considerable reward, an example which has since been followed in our own and other countries. Galileo had no sooner discovered Jupiter's satellites, than he recognized the use which might be made of them for that purpose, and devoted himself with peculiar assiduity to acquiring as perfect a knowledge as possible of their revolutions. The reader will easily understand how they were to be used, if their motion could be so well ascertained as to enable Galileo at Florence to predict the exact times at which any remarkable configurations would occur, as, for instance, the times at which any one of them would be eclipsed by Jupiter. A mariner who in the middle of the Atlantic should observe the same eclipse, and compare the time of night at which he made the observation (which he might know by setting his watch by the sun on the preceding day) with the time mentioned in the predictions, would, from the difference between the two, learn the difference between the hour at Florence and the hour at the place where the ship at that time happened to be. As the earth turns uniformly round through 360° of longitude in 24 hours, that is, through 15° in each hour, the hours, minutes, and seconds of time which express this difference must be multiplied by 15, and the respective products will give the degrees, minutes, and seconds of longitude, by which the ship was then distant from Florence. This statement is merely intended to give those who are unacquainted with astronomy, a general idea of the manner in which it was proposed to use these satellites. Our moon had already been occasionally employed in the same way, but the comparative frequency of the eclipses of Jupiter's moons, and the suddenness with which they disappear, gives a decided advantage to the new method. Both methods were embarrassed by the difficulty of observing the eclipses at sea. In addition to this, it was requisite, in both methods, that the sailors should be provided with accurate means of knowing the hour, wherever they might chance to be, which was far

from being the case, for although (in order not to interrupt the explanation) we have above spoken of their *watches*, yet the watches and clocks of that day were not such as could be relied on sufficiently, during the interval which must necessarily occur between the two observations. This consideration led Galileo to reflect on the use which might be made of his pendulum for this purpose; and, with respect to the other difficulty, he contrived a peculiar kind of telescope, with which he flattered himself, somewhat prematurely, that it would be as easy to observe on ship-board as on shore.

During his stay at Rome, in 1615, and the following year, he disclosed some of these ideas to the Conte di Lemos, the viceroy of Naples, who had been president of the council of the Spanish Indies, and was fully aware of the importance of the matter. Galileo was in consequence invited to communicate directly with the Duke of Lerma, the Spanish minister, and instructions were accordingly sent by Cosmo, to the Conte Orso d'Elci, his ambassador at Madrid, to conduct the business there. Galileo entered warmly into the design, of which he had no other means of verifying the practicability; for as he says in one of his letters to Spain—"Your excellency may well believe that if this were an undertaking which I could conclude by myself, I would never have gone about begging favours from others; but in my study there are neither seas, nor Indies, nor islands, nor ports, nor shoals, nor ships, for which reason I am compelled to share the enterprise with great personages, and to fatigue myself to procure the acceptance of that, which ought with eagerness to be asked of me; but I console myself with the reflection that I am not singular in this, but that it commonly happens, with the exception of a little reputation, and that too often obscured and blackened by envy, that the least part of the advantage falls to the share of the inventors of things, which afterwards bring great gain, honours, and riches to others; so that I will never cease on my part to do every thing in my power, and I am ready to leave here all my comforts, my country, my friends, and family, and to cross over into Spain, to stay as long as I may be wanted in Seville, or Lisbon, or wherever it may be convenient, to implant the knowledge of this method, provided that due assistance and diligence be not wanting on the part of those who are to receive it, and who should solicit and foster it." But he could not, with all his enthusiasm, rouse the attention of the Spanish court. The negotiation languished, and although occasionally renewed during the next ten or twelve years, was never brought to a satisfactory issue. Some explanation of this otherwise unaccountable apathy of the Spanish court, with regard to the solution of a problem which they had certainly much at heart, is given in Nelli's life of Galileo; where it is asserted, on the authority of the Florentine records, that Cosmo required privately from Spain, (in return for the permission granted for Galileo to leave Florence, in pursuance of this design,) the privilege of sending every year from Leghorn two merchantmen, duty free, to the Spanish Indies.

## Chapter XII.

*Controversy on Comets—Saggiatore—Galileo's reception by Urban VIII—His family.*

The year 1618 was remarkable for the appearance of three comets, on which almost every astronomer in Europe found something to say and write. Galileo published some of his opinions with respect to them, through the medium of Mario Guiducci. This astronomer delivered a lecture before the Florentine academy, the heads of which he was supposed to have received from Galileo, who, during the whole time of the appearance of these comets, was confined to his bed by severe illness. This essay was printed in Florence *at the sign of The Medicean Stars*.* What principally deserves notice in it, is the opinion of Galileo, that the distance of a comet cannot be safely determined by its parallax, from which we learn that he inclined to believe that comets are nothing but meteors occasionally appearing in the atmosphere, like rainbows, parhelia, and similar phenomena. He points out the difference in this respect between a fixed object, the distance of which may be calculated from the difference of direction in which two observers (at a known distance from each other) are obliged to turn themselves in order to see it, and meteors like the rainbow, which are simultaneously formed in different drops of water for each spectator, so that two

* In Firenze nella Stamperia di Pietro Cecconcelli alle stelle Medicee, 1619.

observers in different places are in fact contemplating different objects. He then warns astronomers not to engage with too much warmth in a discussion on the distance of comets before they assure themselves to which of these two classes of phenomena they are to be referred. The remark is in itself perfectly just, although the opinion which occasioned it is now as certainly known to be erroneous, but it is questionable whether the observations which, up to that time, had been made upon comets, were sufficient, either in number or quality, to justify the censure which has been cast on Galileo for his opinion. The theory, moreover, is merely introduced as an hypothesis in Guiducci's essay. The same opinion was for a short time embraced by Cassini, a celebrated Italian astronomer, invited by Louis XIV. to the Observatory at Paris, when the science was considerably more advanced, and Newton, in his *Principia*, did not think it unworthy of him to show on what grounds it is untenable.

Galileo was become the object of animosity in so many quarters that none of his published opinions, whether correct or incorrect, ever wanted a ready antagonist. The champion on the present occasion was again a Jesuit; his name was Oratio Grassi, who published *The Astronomical and Philosophical Balance*, under the disguised signature of Lotario Sarsi.

Galileo and his friends were anxious that his reply to Grassi should appear as quickly as possible, but his health had become so precarious and his frequent illnesses occasioned so many interruptions, that it was not until the autumn of 1623 that Il Saggiatore (or The Assayer) as he called his answer, was ready for publication. This was printed by the Lyncean Academy, and as Cardinal Maffeo Barberino, who had just been elected Pope, (with the title of Urban VIII.) had been closely connected with that society, and was also a personal friend of Cesi and of Galileo, it was thought a prudent precaution to dedicate the pamphlet to him. This essay enjoys a peculiar reputation among Galileo's works, not only for the matter contained in it, but also for the style in which it is written; insomuch that Andrès*, when eulogizing Galileo as one of the earliest who adorned philosophical truths with the graces and ornaments of language, expressly instances the Saggiatore, which is also quoted by Frisi and Algarotti, as a perfect model of this sort of composition. In the latter particular, it is unsafe to interfere with the decisions of an Italian critic; but with respect to its substance, this famous composition scarcely appears to deserve its preeminent reputation. It is a prolix and rather tedious examination of Grassi's Essay; nor do the arguments seem so satisfactory, nor the reasonings so compact as is generally the case in Galileo's other writings. It does however, like all his other works, contain many very remarkable passages, and the celebrity of this production requires that we should extract one or two of the most characteristic.

The first, though a very short one, will serve to shew the tone which Galileo had taken with respect to the Copernican system since its condemnation at Rome, in 1616. "In conclusion, since the motion attributed to the earth, which I, as a pious and Catholic person, consider most false, and not to exist, accommodates itself so well to explain so many and such different phenomena, I shall not feel sure, unless Sarsi descends to more distinct considerations than those which he has yet produced, that, false as it is, it may not just as deludingly correspond with the phenomena of comets."

Sarsi had quoted a story from Suidas in support of his argument that motion always produces heat, how the Babylonians used to cook their eggs by whirling them in a sling; to which Galileo replies: "I cannot refrain from marvelling that Sarsi will persist in proving to me, by authorities, that which at any moment I can bring to the test of experiment. We examine witnesses in things which are doubtful, past, and not permanent, but not in those things which are done in our own presence. If discussing a difficult problem were like carrying a weight, since several horses will carry more sacks of corn than one alone will, I would agree that many reasoners avail more than one; but *discoursing* is like *coursing*, and not like carrying, and one barb by himself will run farther than a hundred Friesland horses. When Sarsi brings up such a multitude of authors, it does not seem to me that he in the least degree strengthens his own conclusions, but he ennobles the cause of Signor Mario and myself, by shewing that we reason better than many men of established reputation. If Sarsi insists that I believe,

* Dell' Origine d'ogni Literatura: Parma, 1787.

on Suidas' credit, that the Babylonians cooked eggs by swiftly whirling them in a sling, I will believe it; but I must needs say, that the cause of such an effect is very remote from that to which it is attributed, and to find the true cause I shall reason thus. If an effect does not follow with us which followed with others at another time, it is because, in our experiment, something is wanting which was the cause of the former success; and if only one thing is wanting to us, that one thing is the true cause. Now we have eggs, and slings, and strong men to whirl them, and yet they will not become cooked; nay, if they were hot at first, they more quickly become cold: and since nothing is wanting to us but to be Babylonians, it follows that being Babylonians is the true cause why the eggs became hard, and not the friction of the air, which is what I wished to prove.—Is it possible that in travelling post, Sarsi has never noticed what freshness is occasioned on the face by the continual change of air? and if he has felt it, will he rather trust the relation by others, of what was done two thousand years ago at Babylon, than what he can at this moment verify in his own person? I at least will not be so wilfully wrong, and so ungrateful to nature and to God, that having been gifted with sense and language, I should voluntarily set less value on such great endowments than on the fallacies of a fellow man, and blindly and blunderingly believe whatever I hear, and barter the freedom of my intellect for slavery to one as liable to error as myself."

Our final extract shall exhibit a sample of Galileo's metaphysics, in which may be observed the germ of a theory very closely allied to that which was afterwards developed by Locke and Berkeley.—"I have now only to fulfil my promise of declaring my opinions on the proposition that motion is the cause of heat, and to explain in what manner it appears to me that it may be true. But I must first make some remarks on that which we call heat, since I strongly suspect that a notion of it prevails which is very remote from the truth; for it is believed that there is a true accident, affection, and quality, really inherent in the substance by which we feel ourselves heated. This much I have to say, that so soon as I conceive a material or corporeal substance, I simultaneously feel the necessity of conceiving that it has its boundaries, and is of some shape or other; that, relatively to others, it is great or small; that it is in this or that place, in this or that time; that it is in motion, or at rest; that it touches, or does not touch another body; that it is unique, rare, or common; nor can I, by any act of the imagination, disjoin it from these qualities: but I do not find myself absolutely compelled to apprehend it as necessarily accompanied by such conditions, as that it must be white or red, bitter or sweet, sonorous or silent, smelling sweetly or disagreeably; and if the senses had not pointed out these qualities, it is probable that language and imagination alone could never have arrived at them. Because, I am inclined to think that these tastes, smells, colours, &c., with regard to the subject in which they appear to reside, are nothing more than mere names, and exist only in the sensitive body; insomuch that, when the living creature is removed, all these qualities are carried off and annihilated; although we have imposed particular names upon them, and different from those of the other first and real accidents, and would fain persuade ourselves that they are truly and in fact distinct. But I do not believe that there exists any thing in external bodies for exciting tastes, smells, and sounds, but size, shape, quantity, and motion, swift or slow; and if ears, tongues, and noses were removed, I am of opinion that shape, number, and motion would remain, but there would be an end of smells, tastes, and sounds, which, abstractedly from the living creature, I take to be mere words."

In the spring following the publication of the "Saggiatore," that is to say, about the time of Easter, in 1624, Galileo went a third time to Rome to compliment Urban on his elevation to the pontifical chair. He was obliged to make this journey in a litter; and it appears from his letters that for some years he had been seldom able to bear any other mode of conveyance. In such a state of health it seems unlikely that he would have quitted home on a mere visit of ceremony, which suspicion is strengthened by the beginning of a letter from him to Prince Cesi, dated in October, 1623, in which he says: "I have received the very courteous and prudent advice of your excellency about the time and manner of my going to Rome, and shall act upon it; and I will visit you at Acqua Sparta, that I may be

completely informed of the actual state of things at Rome." However this may be, nothing could be more gratifying than his public reception there. His stay in Rome did not exceed two months, (from the beginning of April till June,) and during that time he was admitted to six long and satisfactory interviews with the Pope, and on his departure received the promise of a pension for his son Vincenzo, and was himself presented with "a fine painting, two medals, one of gold and the other of silver, and a good quantity of agnus dei." He had also much communication with several of the cardinals, one of whom, Cardinal Hohenzoller, told him that he had represented to the pope on the subject of Copernicus, that "all the heretics were of that opinion, and considered it as undoubted; and that it would be necessary to be very circumspect in coming to any resolution: to which his holiness replied, that the church had not condemned it, nor was it to be condemned as heretical, but only as rash; adding, that there was no fear of any one undertaking to prove that it must necessarily be true." Urban also addressed a letter to Ferdinand, who had succeeded his father Cosmo as Grand Duke of Tuscany, expressly for the purpose of recommending Galileo to him. "For We find in him not only literary distinction, but also the love of piety, and he is strong in those qualities by which pontifical good-will is easily obtained. And now, when he has been brought to this city to congratulate Us on Our elevation, We have very lovingly embraced him;—nor can We suffer him to return to the country whither your liberality recalls him without an ample provision of pontifical love. And that you may know how dear he is to Us, We have willed to give him this honourable testimonial of virtue and piety. And We further signify that every benefit which you shall confer upon him, imitating, or even surpassing your father's liberality, will conduce to Our gratification." Honoured with these unequivocal marks of approbation, Galileo returned to Florence.

His son Vincenzo is soon afterwards spoken of as being at Rome; and it is not improbable that Galileo sent him thither on the appointment of his friend and pupil, the Abbé Castelli, to be mathematician to the pope. Vincenzo had been legitimated by an edict of Cosmo in 1619, and, according to Nelli, married, in 1624, Sestilia, the daughter of Carlo Bocchineri. There are no traces to be found of Vincenzo's mother after 1610, and perhaps she died about that time. Galileo's family by her consisted of Vincenzo and two daughters, Julia and Polissena, who both took the veil in the convent of Saint Matthew at Arcetri, under the names of Sister Arcangiola and Sister Maria Celeste. The latter is said to have possessed extraordinary talents. The date of Vincenzo's marriage, as given by Nelli, appears somewhat inconsistent with the correspondence between Galileo and Castelli, in which, so late as 1629, Galileo is apparently writing of his son as a student under Castelli's superintendence, and intimates the amount of pocket-money he can afford to allow him, which he fixes at three crowns a month; adding, that "he ought to be contented with as many crowns, as, at his age, I possessed groats." Castelli had given but an unfavourable account of Vincenzo's conduct, characterizing him as "dissolute, obstinate, and impudent;" in consequence of which behaviour, Galileo seems to have thought that the pension of sixty crowns, which had been granted by the pope, might be turned to better account than by employing it on his son's education; and accordingly in his reply he requested Castelli to dispose of it, observing that the proceeds would be useful in assisting him to discharge a great load of debt with which he found himself saddled on account of his brother's family. Besides this pension, another of one hundred crowns was in a few years granted by Urban to Galileo himself, but it appears to have been very irregularly paid, if at all.

About the same time Galileo found himself menaced either with the deprivation of his stipend as extraordinary professor at Pisa, or with the loss of that leisure which, on his removal to Florence, he had been so anxious to secure. In 1629, the question was agitated by the party opposed to him, whether it were in the power of the grand duke to assign a pension out of the funds of the University, arising out of ecclesiastical dues, to one who neither lectured nor resided there. This scruple had slept during nineteen years which had elapsed since Galileo's establishment in Florence, but probably those who now raised it reckoned upon finding in Ferdinand II., then scarcely

of age, a less firm supporter of Galileo than his father Cosmo had been. But the matter did not proceed so far; for, after full deliberation, the prevalent opinion of the theologians and jurists who were consulted appeared to be in favour of this exercise of prerogative, and accordingly Galileo retained his stipend and privileges.

## Chapter XIII.

*Publication of Galileo's 'System of the World'—His Condemnation and Abjuration.*

In the year 1630, Galileo brought to its conclusion his great work, "The Dialogue on the Ptolemaic and Copernican Systems," and began to take the necessary steps for procuring permission to print it. This was to be obtained in the first instance from an officer at Rome, entitled the master of the sacred palace; and after a little negotiation Galileo found it would be necessary for him again to return thither, as his enemies were still busy in thwarting his views and wishes. Niccolo Riccardi, who at that time filled the office of master of the palace, had been a pupil of Galileo, and was well disposed to facilitate his plans; he pointed out, however, some expressions in the work which he thought it necessary to erase, and, with the understanding that this should be done, he returned the manuscript to Galileo with his subscribed approbation. The unhealthy season was drawing near, and Galileo, unwilling to face it, returned home, where he intended to complete the index and dedication, and then to send it back to Rome to be printed in that city, under the superintendence of Federigo Cesi. This plan was disconcerted by the premature death of that accomplished nobleman, in August 1630, in whom Galileo lost one of his steadiest and most effective friends and protectors. This unfortunate event determined Galileo to attempt to procure permission to print his book at Florence. A contagious disorder had broken out in Tuscany with such severity as almost to interrupt all communication between Florence and Rome, and this was urged by Galileo as an additional reason for granting his request. Riccardi at first seemed inclined to insist that the book should be sent to him a second time, but at last contented himself with inspecting the commencement and conclusion, and consented that (on its receiving also a license from the inquisitor-general at Florence, and from one or two others whose names appear on the title-page) it might be printed where Galileo wished.

These protracted negotiations prevented the publication of the work till late in 1632; it then appeared, with a dedication to Ferdinand, under the following title:—"A Dialogue, by Galileo Galilei, Extraordinary Mathematician of the University of Pisa, and Principal Philosopher and Mathematician of the Most Serene Grand Duke of Tuscany; in which, in a conversation of four days, are discussed the two principal Systems of the World, the Ptolemaic and Copernican, indeterminately proposing the Philosophical Arguments as well on one side as on the other." The beginning of the introduction, which is addressed "To the discreet Reader," is much too characteristic to be passed by without notice.—"Some years ago, a salutary edict was promulgated at Rome, which, in order to obviate the perilous scandals of the present age, enjoined an opportune silence on the Pythagorean opinion of the earth's motion. Some were not wanting, who rashly asserted that this decree originated, not in a judicious examination, but in ill informed passion; and complaints were heard that counsellors totally inexperienced in astronomical observations ought not by hasty prohibitions to clip the wings of speculative minds. My zeal could not keep silence when I heard these rash lamentations, and I thought it proper, as being fully informed with regard to that most prudent determination, to appear publicly on the theatre of the world as a witness of the actual truth. I happened at that time to be in Rome: I was admitted to the audiences, and enjoyed the approbation of the most eminent prelates of that court, nor did the publication of that decree occur without my receiving some prior intimation of it.* Wherefore it is my intention in this present work, to show to foreign nations that as much is known of this matter in Italy, and particularly in Rome, as ultramontane diligence can ever have formed any notion of, and collecting together all my own speculations on the Copernican system, to give them to understand that the knowledge of all these preceded the Roman censures, and that from this

* Delambre quotes this sentence from a passage which is so obviously ironical throughout, as an instance of Galileo's mis-statement of facts!—*Hist. de l'Astr. Mod.*, vol. i. p. 666.

country proceed not only dogmas for the salvation of the soul, but also ingenious discoveries for the gratification of the understanding. With this object, I have taken up in the Dialogue the Copernican side of the question, treating it as a pure mathematical hypothesis; and endeavouring in every artificial manner to represent it as having the advantage, not over the opinion of the stability of the earth absolutely, but according to the manner in which that opinion is defended by some, who indeed profess to be Peripatetics, but retain only the name, and are contented without improvement to worship shadows, not philosophizing with their own reason, but only from the recollection of four principles imperfectly understood."—This very flimsy veil could scarcely blind any one as to Galileo's real views in composing this work, nor does it seem probable that he framed it with any expectation of appearing neutral in the discussion. It is more likely that he flattered himself that, under the new government at Rome, he was not likely to be molested on account of the personal prohibition which he had received in 1616, "not to believe or teach the motion of the earth in any manner," provided he kept himself within the letter of the limits of the more public and general order, that the Copernican system was not to be brought forward otherwise than as a mere mathematically convenient, but in fact unreal supposition. So long as this decree remained in force, a due regard to consistency would compel the Roman Inquisitors to notice an unequivocal violation of it; and this is probably what Urban had implied in the remark quoted by Hohenzoller to Galileo.* There were not wanting circumstances which might compensate for the loss of Cosmo and of Federigo Cesi; Cosmo had been succeeded by his son, who, though he had not yet attained his father's energy, showed himself as friendly as possible to Galileo. Cardinal Bellarmine, who had been mainly instrumental in procuring the decree of 1616, was dead; Urban on the contrary, who had been among the few Cardinals who then opposed it as uncalled for and ill-advised, was now possessed of supreme power, and his recent affability seemed to prove that the increased difference in their stations had not caused him to forget their early and long-continued intimacy. It is probable that Galileo would not have found himself mistaken in this estimate of his position, but for an unlucky circumstance, of which his enemies immediately saw the importance, and which they were not slow in making available against him. The dialogue of Galileo's work is conducted between three personages;—Salviati and Sagredo, who were two noblemen, friends of Galileo, and Simplicio, a name borrowed from a noted commentator upon Aristotle, who wrote in the sixth century. Salviati is the principal philosopher of the work; it is to him that the others apply for solutions of their doubts and difficulties, and on him the principal task falls of explaining the tenets of the Copernican theory. Sagredo is only a half convert, but an acute and ingenious one; to him are allotted the objections which seem to have some real difficulty in them, as well as lively illustrations and digressions, which might have been thought inconsistent with the gravity of Salviati's character. Simplicio, though candid and modest, is of course a confirmed Ptolemaist and Aristotelian, and is made to produce successively all the popular arguments of that school in support of his master's system. Placed between the wit and the philosopher, it may be guessed that his success is very indifferent, and in fact he is alternately ridiculed and confuted at every turn. As Galileo racked his memory and invention to leave unanswered no argument which was or could be advanced against Copernicus, it unfortunately happened, that he introduced some which Urban himself had urged upon him in their former controversies on this subject; and Galileo's opponents found means to make His Holiness believe that the character of Simplicio had been sketched in personal derision of him. We do not think it necessary to exonerate Galileo from this charge; the obvious folly of such an useless piece of ingratitude speaks sufficiently for itself. But self-love is easily irritated; and Urban, who aspired to a reputation for literature and science, was peculiarly sensitive on this point. His own expressions almost prove his belief that such had been Galileo's design, and it seems to explain the otherwise inexplicable change which took place in his conduct towards his old friend, on account of a book which he had himself undertaken to examine, and of which he had authorised the publication.

One of the earliest notices of what was approaching, is found in the dispatches,

* Page 54.

dated August 24, 1632, from Ferdinand's minister, Andrea Cioli, to Francesco Nicolini, the Tuscan ambassador at the court of Rome.

"I have orders to signify to Your Excellency that His Highness remains greatly astonished that a book, placed by the author himself in the hands of the supreme authority in Rome, read and read again there most attentively, and in which every thing, not only with the consent, but at the request of the author, was amended, altered, added, or removed at the will of his superiors, which was again subjected here to the same examination, agreeably to orders from Rome, and which finally was licensed both there and here, and here printed and published, should now become an object of suspicion at the end of two years, and the author and printer be prohibited from publishing any more."—In the sequel is intimated Ferdinand's desire that the charges, of whatever nature they might be, either against Galileo or his book, might be reduced to writing and forwarded to Florence, that he might prepare for his justification; but this reasonable demand was utterly disregarded. It appears to have been owing to the mean subserviency of Cioli to the court of Rome, that Ferdinand refrained from interfering more strenuously to protect Galileo. Cioli's words are: "The Grand Duke is so enraged with this business of Galileo, that I do not know what will be done. I know, at least, that His Holiness shall have no reason to complain of his ministers, or of their bad advice."*

A letter from Galileo's Venetian friend Micanzio, dated about a month later, is in rather a bolder and less formal style:—"The efforts of your enemies to get your book prohibited will occasion no loss either to your reputation, or to the intelligent part of the world. As to posterity, this is just one of the surest ways to hand the book down to them. But what a wretched set this must be to whom every good thing, and all that is founded in nature, necessarily appears hostile and odious! The world is not restricted to a single corner; you will see the book printed in more places and languages than one; and just for this reason, I wish they would prohibit all good books. My disgust arises from seeing myself deprived of what I most desire of this sort, I mean your other dialogues; and if, from this cause, I fail in having the pleasure of seeing them, I shall devote to a hundred thousand devils these unnatural and godless hypocrites."

At the same time, Thomas Campanella, a monk, who had already distinguished himself by an apology for Galileo (published in 1622), wrote to him from Rome:—"I learn with the greatest disgust, that a congregation of angry theologians is forming to condemn your Dialogues, and that no single member of it has any knowledge of mathematics, or familiarity with abstruse speculations. I should advise you to procure a request from the Grand Duke that, among the Dominicans and Jesuits and Theatins, and secular priests whom they are putting on this congregation against your book, they should admit also Castelli and myself." It appears, from subsequent letters both from Campanella and Castelli, that the required letter was procured and sent to Rome, but it was not thought prudent to irritate the opposite party by a request which it was then clearly seen would have been made in vain. Not only were these friends of Galileo not admitted to the congregation, but, upon some pretext, Castelli was even sent away from Rome, as if Galileo's enemies desired to have as few enlightened witnesses as possible of their proceedings; and on the contrary, Scipio Chiaramonte, who had been long known for one of the staunchest and most bigoted defenders of the old system, and who, as Montucla says, seems to have spent a long life in nothing but retarding, as far as he was able, the progress of discovery, was summoned from Pisa to complete their number. From this period we have a tolerably continuous account of the proceedings against Galileo in the dispatches which Nicolini sent regularly to his court. It appears from them that Nicolini had several interviews with the Pope, whom he found highly incensed against Galileo, and in one of the earliest he received an intimation to advise the Duke "not to engage himself in this matter as he had done in the other business of Alidosi,* because he would not get through it with honour." Finding Urban in this humour, Nicolini thought it best to temporize, and to avoid the appearance of any thing like direct opposition. On the 15th of September, probably as soon as the first report on

* Galuzzi. Storia di Toscana. Firenze, 1822.

* Alidosi was a Florentine nobleman, whose estate Urban wished to confiscate on a charge of heresy.—*Galuzzi.*

Galileo's book had been made, Nicolini received a private notice from the Pope, "in especial token of the esteem in which he held the Grand Duke," that he was unable to do less than consign the work to the consideration of the Inquisition. Nicolini was permitted to communicate this to the Grand Duke only, and both were declared liable to "the usual censures" of the Inquisition in case of divulging the secret.

The next step was to summon Galileo to Rome, and the only answer returned to all Nicolini's representations of his advanced age of seventy years, the very infirm state of his health, and the discomforts which he must necessarily suffer in such a journey, and in keeping quarantine, was that he might come at leisure, and that the quarantine should be relaxed as much as possible in his favour, but that it was indispensably necessary that he should be personally examined before the Inquisition at Rome. Accordingly, on the 14th of February, 1633, Nicolini announces Galileo's arrival, and that he had officially notified his presence to the Assessor and Commissary of the Holy Office. Cardinal Barberino, Urban's nephew, who seems on the whole to have acted a friendly part towards Galileo, intimated to him that his most prudent course would be to keep himself as much at home and as quiet as possible, and to refuse to see any but his most intimate friends. With this advice, which was repeated to him from several quarters, Galileo thought it best to comply, and kept himself entirely secluded in Nicolini's palace, where he was as usual maintained at the expense of the Grand Duke. Nelli quotes two letters, which passed between Ferdinand's minister Cioli and Nicolini, in which the former intimated that Galileo's expenses were to be defrayed only during the first month of his residence at Rome. Nicolini returned a spirited answer, that in that case, after the time specified, he should continue to treat him as before at his own private cost.

The permission to reside at the ambassador's palace whilst his cause was pending, was granted and received as an extraordinary indulgence on the part of the Inquisition, and indeed if we estimate the proceedings throughout against Galileo by the usual practice of that detestable tribunal, it will appear that he was treated with unusual consideration. Even when it became necessary in the course of the inquiry to examine him in person, which was in the beginning of April, although his removal to the Holy Office was then insisted upon, yet he was not committed to close or strictly solitary confinement. On the contrary, he was honourably lodged in the apartments of the Fiscal of the Inquisition, where he was allowed the attendance of his own servant, who was also permitted to sleep in an adjoining room, and to come and go at pleasure. His table was still furnished by Nicolini. But, notwithstanding the distinction with which he was thus treated, Galileo was annoyed and uneasy at being (though little more than nominally) within the walls of the Inquisition. He became exceedingly anxious that the matter should be brought to a conclusion, and a severe attack of his constitutional complaints rendered him still more fretful and impatient. On the last day of April, about ten days after his first examination, he was unexpectedly permitted to return to Nicolini's house, although the proceedings were yet far from being brought to a conclusion. Nicolini attributes this favour to Cardinal Barberino, who, he says, liberated Galileo on his own responsibility, in consideration of the enfeebled state of his health.

In the society of Nicolini and his family, Galileo recovered something of his courage and ordinary cheerfulness, although his return appears to have been permitted on express condition of a strict seclusion; for at the latter end of May, Nicolini was obliged to apply for permission that Galileo should take that exercise in the open air which was necessary for his health; on which occasion he was permitted to go into the public gardens in a half-closed carriage.

On the evening of the 20th of June, rather more than four months after Galileo's arrival in Rome, he was again summoned to the Holy Office, whither he went the following morning; he was detained there during the whole of that day, and on the next day was conducted in a penitential dress * to the Convent of Minerva, where the Cardinals and Prelates, his judges, were assembled for the purpose of passing judgment upon him, by which this venerable old man was solemnly called upon to renounce and abjure, as impious and heretical, the opinions which his whole existence had been consecrated to form and strengthen.

* S' irrito il Papa, e lo fece abjurare, comparendo il pover uomo con uno straccio di camicia indosso, che faceva compassione, MS. nella Bibl. Magliab. Venturi.

As we are not aware that this remarkable record of intolerance and bigoted folly has ever been printed entire in English, we subjoin a literal translation of the whole sentence and abjuration.

*The Sentence of the Inquisition on Galileo.*

"We, the undersigned, by the Grace of God, Cardinals of the Holy Roman Church, Inquisitors General throughout the whole Christian Republic, Special Deputies of the Holy Apostolical Chair against heretical depravity,

"Whereas you, Galileo, son of the late Vincenzo Galilei of Florence, aged seventy years, were denounced in 1615 to this Holy Office, for holding as true a false doctrine taught by many, namely, that the sun is immoveable in the centre of the world, and that the earth moves, and also with a diurnal motion; also, for having pupils whom you instructed in the same opinions; also, for maintaining a correspondence on the same with some German mathematicians; also for publishing certain letters on the solar spots, in which you developed the same doctrine as true; also, for answering the objections which were continually produced from the Holy Scriptures, by glozing the said Scriptures according to your own meaning; and whereas thereupon was produced the copy of a writing, in form of a letter, professedly written by you to a person formerly your pupil, in which, following the hypotheses of Copernicus, you include several propositions contrary to the true sense and authority of the Holy Scripture: therefore this holy tribunal being desirous of providing against the disorder and mischief which was thence proceeding and increasing to the detriment of the holy faith, by the desire of His Holiness, and of the Most Eminent Lords Cardinals of this supreme and universal Inquisition, the two propositions of the stability of the sun, and motion of the earth, were *qualified* by the *Theological Qualifiers* as follows:

"1*st. The proposition that the Sun is in the centre of the world and immoveable from its place, is absurd, philosophically false, and formally heretical; because it is expressly contrary to the Holy Scripture.*

"2*dly. The proposition that the Earth is not the centre of the world, nor immoveable, but that it moves, and also with a diurnal motion, is also absurd, philosophically false, and, theologically considered, at least erroneous in faith.*

"But whereas being pleased at that time to deal mildly with you, it was decreed in the Holy Congregation, held before His Holiness on the 25th day of February, 1616, that His Eminence the Lord Cardinal Bellarmine should enjoin you to give up altogether the said false doctrine; if you should refuse, that you should be ordered by the Commissary of the Holy Office to relinquish it, not to teach it to others, nor to defend it, nor ever mention it, and in default of acquiescence that you should be imprisoned; and in execution of this decree, on the following day at the palace, in presence of His Eminence the said Lord Cardinal Bellarmine, after you had been mildly admonished by the said Lord Cardinal, you were commanded by the acting Commissary of the Holy Office, before a notary and witnesses, to relinquish altogether the said false opinion, and in future neither to defend nor teach it in any manner, neither verbally nor in writing, and upon your promising obedience you were dismissed.

"And in order that so pernicious a doctrine might be altogether rooted out, nor insinuate itself farther to the heavy detriment of the Catholic truth, a decree emanated from the Holy Congregation of the Index* prohibiting the books which treat of this doctrine; and it was declared false, and altogether contrary to the Holy and Divine Scripture.

"And whereas a book has since appeared, published at Florence last year, the title of which shewed that you were the author, which title is: *The Dialogue of Galileo Galilei, on the two principal systems of the world, the Ptolemaic and Copernican;* and whereas the Holy Congregation has heard that, in consequence of the printing of the said book, the false opinion of the earth's motion and stability of the sun is daily gaining ground; the said book has been taken into careful consideration, and in it has been detected a glaring violation of the said order, which had been intimated to you; inasmuch as in this book you have

* The Index is a list of books, the reading of which is prohibited to Roman Catholics. This list, in the early periods of the Reformation, was often consulted by the curious, who were enlarging their libraries; and a story is current in England, that, to prevent this mischief, the Index itself was inserted in its own forbidden catalogue. The origin of this story is, that an Index was published in Spain, particularizing the objectionable passages in such books as were only partially condemned; and although compiled with the best intentions, this was found to be so racy, that it became necessary to forbid the circulation of this edition in subsequent lists.

defended the said opinion, already and in your presence condemned; although in the said book you labour with many circumlocutions to induce the belief that it is left by you undecided, and in express terms probable: which is equally a very grave error, since an opinion can in no way be probable which has been already declared and finally determined contrary to the divine Scripture. Therefore by Our order you have been cited to this Holy Office, where, on your examination upon oath, you have acknowledged the said book as written and printed by you. You also confessed that you began to write the said book ten or twelve years ago, after the order aforesaid had been given. Also, that you demanded license to publish it, but without signifying to those who granted you this permission that you had been commanded not to hold, defend, or teach the said doctrine in any manner. You also confessed that the style of the said book was, in many places, so composed that the reader might think the arguments adduced on the false side to be so worded as more effectually to entangle the understanding than to be easily solved, alleging in excuse, that you have thus run into an error, foreign (as you say) to your intention, from writing in the form of a dialogue, and in consequence of the natural complacency which every one feels with regard to his own subtilties, and in showing himself more skilful than the generality of mankind in contriving, even in favour of false propositions, ingenious and apparently probable arguments.

"And, upon a convenient time being given to you for making your defence, you produced a certificate in the handwriting of His Eminence the Lord Cardinal Bellarmine, procured, as you said, by yourself, that you might defend yourself against the calumnies of your enemies, who reported that you had abjured your opinions, and had been punished by the Holy Office; in which certificate it is declared, that you had not abjured, nor had been punished, but merely that the declaration made by His Holiness, and promulgated by the Holy Congregation of the Index, had been announced to you, which declares that the opinion of the motion of the earth, and stability of the sun, is contrary to the Holy Scriptures, and, therefore, cannot be held or defended. Wherefore, since no mention is there made of two articles of the order, to wit, the order 'not to teach,' and 'in any manner,' you argued that we ought to believe that, in the lapse of fourteen or sixteen years, they had escaped your memory, and that this was also the reason why you were silent as to the order, when you sought permission to publish your book, and that this is said by you not to excuse your error, but that it may be attributed to vain-glorious ambition, rather than to malice. But this very certificate, produced on your behalf, has greatly aggravated your offence, since it is therein declared that the said opinion is contrary to the Holy Scripture, and yet you have dared to treat of it, to defend it, and to argue that it is probable; nor is there any extenuation in the licence artfully and cunningly extorted by you, since you did not intimate the command imposed upon you. But whereas it appeared to Us that you had not disclosed the whole truth with regard to your intentions, We thought it necessary to proceed to the rigorous examination of you, in which (without any prejudice to what you had confessed, and which is above detailed against you, with regard to your said intention) you answered like a good Catholic.

"Therefore, having seen and maturely considered the merits of your cause, with your said confessions and excuses, and every thing else which ought to be seen and considered, We have come to the underwritten final sentence against you.

"Invoking, therefore, the most holy name of Our Lord Jesus Christ, and of His Most Glorious Virgin Mother Mary, by this Our final sentence, which, sitting in council and judgment for the tribunal of the Reverend Masters of Sacred Theology, and Doctors of both Laws, Our Assessors, We put forth in this writing touching the matters and controversies before Us, between The Magnificent Charles Sincerus, Doctor of both Laws, Fiscal Proctor of this Holy Office of the one part, and you, Galileo Galilei, an examined and confessed criminal from this present writing now in progress as above of the other part, We pronounce, judge, and declare, that you, the said Galileo, by reason of these things which have been detailed in the course of this writing, and which, as above, you have confessed, have rendered yourself vehemently suspected by this Holy Office of heresy: that is to say, that you believe and hold the false doctrine, and contrary to the Holy

and Divine Scriptures, namely, that the sun is the centre of the world, and that it does not move from east to west, and that the earth does move, and is not the centre of the world; also that an opinion can be held and supported as probable after it has been declared and finally decreed contrary to the Holy Scripture, and consequently that you have incurred all the censures and penalties enjoined and promulgated in the sacred canons, and other general and particular constitutions against delinquents of this description. From which it is Our pleasure that you be absolved, provided that, first, with a sincere heart and unfeigned faith, in Our presence, you abjure, curse, and detest the said errors and heresies, and every other error and heresy contrary to the Catholic and Apostolic Church of Rome, in the form now shown to you.

"But, that your grievous and pernicious error and transgression may not go altogether unpunished, and that you may be made more cautious in future, and may be a warning to others to abstain from delinquencies of this sort, We decree that the book of the dialogues of Galileo Galilei be prohibited by a public edict, and We condemn you to the formal prison of this Holy Office for a period determinable at Our pleasure; and, by way of salutary penance, We order you, during the next three years, to recite once a week the seven penitential psalms, reserving to Ourselves the power of moderating, commuting, or taking off the whole or part of the said punishment and penance.

"And so We say, pronounce, and by Our sentence declare, decree, and reserve, in this and in every other better form and manner, which lawfully We may and can use.

"So We, the subscribing Cardinals, pronounce.

Felix, Cardinal di Ascoli,
Guido, Cardinal Bentivoglio,
Desiderio, Cardinal di Cremona,
Antonio, Cardinal S. Onofrio,
Berlingero, Cardinal Gessi,
Fabricio, Cardinal Verospi,
Martino, Cardinal Ginetti."

We cannot suppose that Galileo, even broken down as he was with age and infirmities, and overawed by the merciless tribunal to whose power he was subjected, could without extreme reluctance thus formally give the lie to his whole life, and call upon God to witness his renunciation of the opinions which even his bigoted judges must have felt that he still clung to in his heart.

We know indeed that his friends were unanimous in recommending an unqualified acquiescence in whatever might be required, but some persons have not been able to find an adequate explanation of his submission, either in their exhortations, or in the mere dread of the alternative which might await him in case of non-compliance. It has in short been supposed, although the suspicion scarcely rests upon grounds sufficiently strong to warrant the assertion, that Galileo did not submit to this abjuration until forced to it, not merely by the apprehension, but by the actual experience of personal violence. The arguments on which this horrible idea appears to be mainly founded are the two following: First, the Inquisitors declare in their sentence that, not satisfied with Galileo's first confession, they judged it necessary to proceed "to the rigorous examination of him, in which he answered like a good Catholic.*" It is pretended by those who are more familiar with inquisitorial language than we can profess to be, that the words *il rigoroso esame*, form the official phrase for the application of the torture, and accordingly they interpret this passage to mean, that the desired answers and submission had thus been extorted from Galileo, which his judges had otherwise failed to get from him. And, secondly, the partisans of this opinion bring forward in corroboration of it, that Galileo immediately on his departure from Rome, in addition to his old complaints, was found to be afflicted with hernia, and this was a common consequence of the torture of the cord, which they suppose to have been inflicted. It is right to mention that no other trace can be found of this supposed torturing in all the documents relative to the proceedings against Galileo, at least Venturi was so assured by one who had inspected the originals at Paris.†

* Giudicassimo esser necessario venir contro di te al rigoroso esame nel quale rispondesti cattolicamente.

† The fate of these documents is curious; after being long preserved at Rome, they were carried away in 1809, by order of Buonaparte, to Paris, where they remained till his first abdication. Just before the hundred days, the late king of France, wishing to inspect them, ordered that they should be brought to his own apartments for that purpose. In the hasty flight which soon afterwards followed, the manuscripts were forgotten, and it is not known what became of them. A French translation, begun by Napoleon's desire, was completed only down to the 30th of April, 1633, the date of Galileo's first return to Nicolini's palace.

Although the arguments we have mentioned appear to us slight, yet neither can we attach much importance to the contrast which the favourers of the opposite opinion profess to consider so incredible between the honourable manner in which Galileo was treated throughout the rest of the inquiry, and the suspected harsh proceeding against him. Whether Galileo should be lodged in a prison or a palace, was a matter of far other importance to the Inquisitors and to their hold upon public opinion, than the question whether or not he should be suffered to exhibit a persevering resistance to the censures which they were prepared to cast upon him. Nor need we shrink from the idea, as we might from suspecting of some gross crime, on trivial grounds, one of hitherto unblemished innocence and character. The question may be disencumbered of all such scruples, since one atrocity more or less can do little towards affecting our judgment of the unholy Office of the Inquisition.

Delambre, who could find so much to reprehend in Galileo's former uncompromising boldness, is deeply penetrated with the insincerity of his behaviour on the present occasion. He seems to have forgotten that a tribunal which finds it convenient to carry on its inquiries in secret, is always liable to the suspicion of putting words into the mouth of its victims; and if it were worth while, there is sufficient internal evidence that the language which Galileo is made to hold in his defence and confession, is rather to be read as the composition of his judges than his own. For instance, in one of the letters which we have extracted*, it may be seen that this obnoxious work was already in forward preparation as early as 1610, and yet he is made to confess, and the circumstance appears to be brought forward in aggravation of his guilt, that he began to write it after the prohibition which he had received in 1616.

The abjuration was drawn up in the following terms:—

*The Abjuration of Galileo.*

"I Galileo Galilei, son of the late Vincenzo Galilei, of Florence, aged 70 years, being brought personally to judgment, and kneeling before you, Most Eminent and Most Reverend Lords Cardinals, General Inquisitors of the universal Christian republic against heretical depravity, having before my eyes the Holy Gospels, which I touch with my own hands, swear, that I have always believed, and now believe, and with the help of God will in future believe, every article which the Holy Catholic and Apostolic Church of Rome holds, teaches, and preaches. But because I had been enjoined by this Holy Office altogether to abandon the false opinion which maintains that the sun is the centre and immoveable, and forbidden to hold, defend, or teach, the said false doctrine in any manner, and after it had been signified to me that the said doctrine is repugnant with the Holy Scripture, I have written and printed a book, in which I treat of the same doctrine now condemned, and adduce reasons with great force in support of the same, without giving any solution, and therefore have been judged grievously suspected of heresy; that is to say, that I held and believed that the sun is the centre of the world and immoveable, and that the earth is not the centre and moveable, Willing, therefore, to remove from the minds of Your Eminences, and of every Catholic Christian, this vehement suspicion rightfully entertained towards me, with a sincere heart and unfeigned faith, I abjure, curse, and detest, the said errors and heresies, and generally every other error and sect contrary to the said Holy Church; and I swear, that I will never more in future say or assert anything verbally, or in writing, which may give rise to a similar suspicion of me: but if I shall know any heretic, or any one suspected of heresy, that I will denounce him to this Holy Office, or to the Inquisitor and Ordinary of the place in which I may be. I swear, moreover, and promise, that I will fulfil, and observe fully, all the penances which have been, or shall be laid on me by this Holy Office. But if it shall happen that I violate any of my said promises, oaths, and protestations, (which God avert!) I subject myself to all the pains and punishments, which have been decreed and promulgated by the sacred canons, and other general and particular constitutions, against delinquents of this description. So may God help me, and his Holy Gospels which I touch with my own hands. I the above-named Galileo Galilei, have abjured, sworn, promised, and bound myself, as above, and in witness thereof with my own hand have subscribed this present writing of my abjuration, which

* Page 18.

I have recited word for word. At Rome in the Convent of Minerva, 22d June, 1633. I, Galileo Galilei, have abjured as above with my own hand."

It is said that Galileo, as he rose from his knees, stamped on the ground, and whispered to one of his friends, *E pur si muove*—(It does move though).

Copies of Galileo's sentence and abjuration were immediately promulgated in every direction, and the professors at several universities received directions to read them publicly. At Florence this ceremony took place in the church of Sta. Croce, whither Guiducci, Aggiunti, and all others who were known in that city as firm adherents to Galileo's opinions, were specially summoned. The triumph of the "Paper Philosophers" was so far complete, and the alarm occasioned by this proof of their dying power extended even beyond Italy. "I have been told," writes Descartes from Holland to Mersenne at Paris, "that Galileo's system was printed in Italy last year, but that every copy has been burnt at Rome, and himself condemned to some sort of penance, which has astonished me so much that I have almost determined to burn all my papers, or at least never to let them be seen by any one. I cannot collect that he, who is an Italian and even a friend of the Pope, as I understand, has been criminated on any other account than for having attempted to establish the motion of the earth. I know that this opinion was formerly censured by some Cardinals, but I thought I had since heard, that no objection was now made to its being publicly taught, even at Rome."

The sentiments of all who felt themselves secured against the apprehension of personal danger could take but one direction, for, as Pascal well expressed it in one of his celebrated letters to the Jesuits—"It is in vain that you have procured against Galileo a decree from Rome condemning his opinion of the earth's motion. Assuredly, that will never prove it to be at rest; and if we have unerring observations proving that it turns round, not all mankind together can keep it from turning, nor themselves from turning with it."

The assembly of doctors of the Sorbonne at Paris narrowly escaped from passing a similar sentence upon the system of Copernicus. The question was laid before them by Richelieu, and it appears that their opinion was for a moment in favour of confirming the Roman decree. It is to be wished that the name had been preserved of one of its members, who, by his strong and philosophical representations, saved that celebrated body from this disgrace.

Those who saw nothing in the punishment of Galileo but passion and blinded superstition, took occasion to revert to the history of a similar blunder of the Court of Rome in the middle of the eighth century. A Bavarian bishop, named Virgil, eminent both as a man of letters and politician, had asserted the existence of Antipodes, which excited in the ignorant bigots of his time no less alarm than did the motion of the earth in the seventeenth century. Pope Zachary, who was scandalized at the idea of another earth, inhabited by another race of men, and enlightened by another sun and moon (for this was the shape which Virgil's system assumed in his eyes), sent out positive orders to his legate in Bavaria. "With regard to Virgil, the philosopher, (I know not whether to call him priest,) if he own these perverse opinions, strip him of his priesthood, and drive him from the church and altars of God." But Virgil had himself occasionally acted as legate, and was moreover too necessary to his sovereign to be easily displaced. He utterly disregarded these denunciations, and during twenty-five years which elapsed before his death, retained his opinions, his bishopric of Salzburg, and his political power. He was afterwards canonized*.

Even the most zealous advocates of the authority of Rome were embarrassed in endeavouring to justify the treatment which Galileo experienced. Tiraboschi has attempted to draw a somewhat subtle distinction between the bulls of the Pope and the inquisitorial decrees which were sanctioned and approved by him; he dwells on the reflection that no one, even among the most zealous Catholics, has ever claimed infallibility as an attribute of the Inquisition, and looks upon it as a special mark of grace accorded to the Roman Catholic Church, that during the whole period in which most theologians rejected the opinions of Copernicus, as contrary to the Scriptures, the head of that Church was never permitted to compromise his infallible character by formally condemning it †.

Whatever may be the value of this

* Annalium Bolorum, libri vii. Ingolstadii, 1554.

† La Chiesa non ha mai dichiarati eretici i sostenitori del Sistema Copernicano, e questa troppo rigorosa censura non usci che dal tribunale della Romana Inquisizione a cui niuno tra Cattolici ancor piu zelanti ha mai attribuito il diritto dell' infalli-

consolation, it can hardly be conceded, unless it be at the same time admitted that many scrupulous members of the Church of Rome have been suffered to remain in singular misapprehension of the nature and sanction of the authority to which Galileo had yielded. The words of the bull of Sixtus V., by which the Congregation of the Index was remodelled in 1588, are quoted by a professor of the University of Louvain, a zealous antagonist of Galileo, as follows: "They are to examine and expose the books which are repugnant to the Catholic doctrines and Christian discipline, and after reporting on them to us, they are to condemn them by our authority.*" Nor does it appear that the learned editors of what is commonly called the Jesuit's edition of Newton's "Principia" were of opinion, that in adopting the Copernican system they should transgress a mandate emanating from any thing short of infallible wisdom. The remarkable words which they were compelled to prefix to their book, show how sensitive the court of Rome remained, even so late as 1742, with regard to this rashly condemned theory. In their preface they say: "Newton in this third book supposes the motion of the earth. We could not explain the author's propositions otherwise than by making the same supposition. We are therefore forced to sustain a character which is not our own; but we profess to pay the obsequious reverence which is due to the decrees pronounced by the supreme Pontiffs against the motion of the earth."†

This coy reluctance to admit what nobody any longer doubts has survived to the present time; for Bailli informs us,‡ that the utmost endeavours of Lalande, when at Rome, to obtain that Galileo's work should be erased from the Index, were entirely ineffectual, in consequence of the decree which had been fulminated against him; and in fact both it, and the book of Copernicus, "Nisi Corrigatur," are still to be seen on the forbidden list of 1828.

The condemnation of Galileo and his book was not thought sufficient. Urban's indignation also vented itself upon those who had been instrumental in obtaining the licence for him. The Inquisitor at Florence was reprimanded; Riccardi, the master of the sacred palace, and Ciampoli, Urban's secretary, were both dismissed from their situations. Their punishment appears rather anomalous and inconsistent with the proceedings against Galileo, in which it was assumed that his book was not properly licensed; yet the others suffered on account of granting that very licence, which he was accused of having surreptitiously obtained from them, by concealing circumstances with which they were not bound to be otherwise acquainted. Riccardi, in exculpation of his conduct, produced a letter in the hand-writing of Ciampoli, in which was contained that His Holiness, in whose presence the letter professed to be written, ordered the licence to be given. Urban only replied that this was a Ciampolism; that his secretary and Galileo had circumvented him; that he had already dismissed Ciampoli, and that Riccardi must prepare to follow him.

As soon as the ceremony of abjuration was concluded, Galileo was consigned, pursuant to his sentence, to the prison of the Inquisition. Probably it was never intended that he should long remain there, for at the end of four days, he was reconducted on a very slight representation of Nicolini to the ambassador's palace, there to await his further destination. Florence was still suffering under the before-mentioned contagion; and Sienna was at last fixed on as the place of his relegation. He would have been shut up in some convent in that city, if Nicolini had not recommended as a more suitable residence, the palace of the Archishop Piccolomini, whom he knew to be among Galileo's warmest friends. Urban consented to the change, and Galileo finally left Rome for Sienna in the early part of July.

Piccolomini received him with the utmost kindness, controlled of course by the strict injunctions which were dispatched from Rome, not to suffer him on any account to quit the confines of the palace. Galileo continued at Sienna in this state of seclusion till December of the same year, when the contagion having ceased in Tuscany, he applied for permission to return to his villa at Arcetri. This was allowed, subject to the same restrictions under which he had been residing with the archbishop.

bilità. Anzi in cio ancora è d' ammirarsi la providenza di Dio à favor della Chiesa, percioche in un tempo in cui la maggior parte dei teologi fermamente credavano che il Sistema Copernicano fosse all' autorità delle sacre Carte contrario, pur non permise che dalla Chiesa si proferisse su cio un solenne giudizio.—Stor. della Lett. Ital.

* Lib. Fromondi Antaristarchus, Antwerpiæ, 1631.

† Newtoni Principia, Coloniæ, 1760.

‡ Histoire de l'Astronomie Moderne.

## Chapter XIV.

### *Extracts from the Dialogues on the System.*

After narrating the treatment to which Galileo was subject on account of his admirable Dialogues, it will not be irrelevant to endeavour, by a few extracts, to convey some idea of the style in which they are written. It has been mentioned, that he is considered to surpass all other Italian writers (unless we except Machiavelli) in the purity and beauty of his language, and indeed his principal followers, who avowedly imitated his style, make a distinguished group among the classical authors of modern Italy. He professed to have formed himself from the study of Ariosto, whose poems he passionately admired, insomuch that he could repeat the greater part of them, as well as those of Berni and Petrarca, all which he was in the frequent habit of quoting in conversation. The fashion and almost universal practice of that day was to write on philosophical subjects in Latin; and although Galileo wrote very passably in that language, yet he generally preferred the use of Italian, for which he gave his reasons in the following characteristic manner:—

"I wrote in Italian because I wished every one to be able to read what I wrote; and for the same cause I have written my last treatise in the same language: the reason which has induced me is, that I see young men brought together indiscriminately to study to become physicians, philosophers, &c., and whilst many apply to such professions who are most unfit for them, others who would be competent remain occupied either with domestic business, or with other employments alien to literature; who, although furnished, as Ruzzante might say, with a *decent set of brains*, yet, not being able to understand things written in *gibberish*, take it into their heads, that in these crabbed folios there must be some grand *hocus pocus* of logic and philosophy much too high up for them to think of jumping at. I want them to know, that as Nature has given eyes to them just as well as to philosophers for the purpose of seeing her works, she has also given them brains for examining and understanding them."

The general structure of the dialogues has been already described*; we shall therefore premise no more than the judgment pronounced on them by a highly gifted writer, to supply the deficiencies of our necessarily imperfect analysis.

"One forms a very imperfect idea of Galileo, from considering the discoveries and inventions, numerous and splendid as they are, of which he was the undisputed author. It is by following his reasonings, and by pursuing the train of his thoughts, in his own elegant, though somewhat diffuse exposition of them, that we become acquainted with the fertility of his genius—with the sagacity, penetration, and comprehensiveness of his mind. The service which he rendered to real knowledge is to be estimated, not only from the truths which he discovered, but from the errors which he detected—not merely from the sound principles which he established, but from the pernicious idols which he overthrew. The dialogues on the system are written with such singular felicity, that one reads them at the present day, when the truths contained in them are known and admitted, with all the delight of novelty, and feels one's self carried back to the period when the telescope was first directed to the heavens, and when the earth's motion, with all its train of consequences, was proved for the first time."*

The first Dialogue is opened by an attack upon the arguments by which Aristotle pretended to determine *à priori* the necessary motions belonging to different parts of the world, and on his favourite principle that particular motions belong naturally to particular substances. Salviati (representing Galileo) then objects to the Aristotelian distinctions between the corruptible elements and incorruptible skies, instancing among other things the solar spots and newly appearing stars, as arguments that the other heavenly bodies may probably be subjected to changes similar to those which are continually occurring on the earth, and that it is the great distance alone which prevents their being observed. After a long discussion on this point, Sagredo exclaims, "I see into the heart of Simplicio, and perceive that he is much moved by the force of these too conclusive arguments; but methinks I hear him say—'Oh, to whom must we betake ourselves to settle our disputes if Aristotle be removed from the chair? What

* See page 56.

* Playfair's Dissertation, Supp. Encyc. Brit.

other author have we to follow in our schools, our studies, and academies? What philosopher has written on all the parts of Natural Philosophy, and so methodically as not to have overlooked a single conclusion? Must we then desolate this fabric, by which so many travellers have been sheltered? Must we destroy this asylum, this Prytaneum wherein so many students have found a convenient resting-place, where without being exposed to the injuries of the weather, one may acquire an intimate knowledge of nature, merely by turning over a few leaves? Shall we level this bulwark, behind which we are safe from every hostile attack? I pity him no less than I do one who at great expense of time and treasure, and with the labour of hundreds, has built up a very noble palace; and then, because of insecure foundations, sees it ready to fall—unable to bear that those walls be stripped that are adorned with so many beautiful pictures, or to suffer those columns to fall that uphold the stately galleries, or to see ruined the gilded roofs, the chimney-pieces, the friezes, and marble cornices erected at so much cost, he goes about it with girders and props, with shores and buttresses, to hinder its destruction."

Salviati proceeds to point out the many points of similarity between the earth and moon, and among others which we have already mentioned, the following remark deserves especial notice:—

"Just as from the mutual and universal tendency of the parts of the earth to form a whole, it follows that they all meet together with equal inclination, and that they may unite as closely as possible, assume the spherical form; why ought we not to believe that the moon, the sun, and other mundane bodies are also of a round figure, from no other reason than from a common instinct and natural concourse of all their component parts; of which if by accident any one should be violently separated from its whole, is it not reasonable to believe that spontaneously, and of its natural instinct, it would return? It may be added that if any centre of the universe may be assigned, to which the whole terrene globe if thence removed would seek to return, we shall find most probable that the sun is placed in it, as by the sequel you shall understand."

Many who are but superficially acquainted with the History of Astronomy, are apt to suppose that Newton's great merit was in his being the first to suppose an attractive force existing in and between the different bodies composing the solar system. This idea is very erroneous; Newton's discovery consisted in conceiving and proving the identity of the force with which a stone falls, and that by which the moon falls, towards the earth (on an assumption that this force becomes weaker in a certain proportion as the distance increases at which it operates), and in generalizing this idea, in applying it to all the visible creation, and tracing the principle of universal gravitation with the assistance of a most refined and beautiful geometry into many of its most remote consequences. But the general notion of an attractive force between the sun, moon, and planets, was very commonly entertained before Newton was born, and may be traced back to Kepler, who was probably the first modern philosopher who suggested it. The following extraordinary passages from his "Astronomy" will shew the nature of his conceptions on this subject:—

"The true doctrine of gravity is founded on these axioms: every corporeal substance, so far forth as it is corporeal, has a natural fitness for resting in every place where it may be situated by itself beyond the sphere of influence of its cognate body. Gravity is a mutual affection between cognate bodies towards union or conjunction (similar in kind to the magnetic virtue), so that the earth attracts a stone much rather than the stone seeks the earth. Heavy bodies (if in the first place we put the earth in the centre of the world) are not carried to the centre of the world in its quality of centre of the world, but as to the centre of a cognate round body, namely the earth. So that wheresoever the earth may be placed or whithersoever it may be carried by its animal faculty, heavy bodies will always be carried towards it. If the earth were not round heavy bodies would not tend from every side in a straight line towards the centre of the earth, but to different points from different sides. If two stones were placed in any part of the world near each other and beyond the sphere of influence of a third cognate body, these stones, like two magnetic needles, would come together in the intermediate point, each approaching the other by a space pro-

portional to the comparative mass of the other. If the moon and earth were not retained in their orbits by their animal force or some other equivalent, the earth would mount to the moon by a fifty-fourth part of their distance, and the moon fall towards the earth through the other fifty-three parts, and would there meet, assuming however that the substance of both is of the same density. If the earth should cease to attract its waters to itself, all the waters of the sea would be raised, and would flow to the body of the moon *."

He also conjectured that the irregularities in the moon's motion were caused by the joint action of the sun and earth, and recognized the mutual action of the sun and planets, when he declared the mass and density of the sun to be so great that the united attraction of the other planets cannot remove it from its place. Among these bold and brilliant ideas, his temperament led him to introduce others which show how unsafe it was to follow his guidance, and which account for, if they do not altogether justify, the sarcastic remark of Ross, that "Kepler's opinion that the planets are moved round by the sunne, and that this is done by sending forth a magnetic virtue, and that the sun-beames are like the teethe of a wheele taking hold of the planets, are senslesse crotchets fitter for a wheeler or a miller than a philosopher."† Roberval took up Kepler's notions, especially in the tract which he falsely attributed to Aristarchus, and it is much to be regretted that Roberval should deserve credit for anything connected with that impudent fraud. The principle of universal gravitation, though not the varying proportion, is distinctly assumed in it, as the following passages will sufficiently prove: "In every single particle of the earth, and the terrestrial elements, is a certain property or accident which we suppose common to the whole system of the world, by virtue of which all its parts are forced together, and reciprocally attract each other; and this property is found in a greater or less degree in the different particles, according to their density. If the earth be considered by itself, its centres of magnitude and virtue, or gravity, as we usually call it, will coincide, to which all its parts tend in a straight line, as well by their own exertion or gravity, as by the reciprocal attraction of all the rest." In a subsequent chapter, Roberval repeats these passages nearly in the same words, applying them to the whole solar system, adding, that "the force of this attraction is not to be considered as residing in the centre itself, as some ignorant people think, but in the whole system whose parts are equally disposed round the centre*". This very curious work was reprinted in the third volume of the *Reflexiones Physico-Mathematicæ* of Mersenne, from whom Roberval pretended to have received the Arabic manuscript, and who is thus irretrievably implicated in the forgery.† The last remark, denying the attractive force to be due to any property of the central point, seems aimed at Aristotle, who, in a no less curious passage, maintaining exactly the opposite opinion, says, "Hence, we may better understand what the ancients have related, that like things are wont to have a tendency to each other. For this is not absolutely true; for if the earth were to be removed to the place now occupied by the moon, no part of the earth would then have a tendency towards that place, but would still fall towards the point which the earth's centre now occupies."‡ Mersenne considered the consequences of the attractive force of each particle of matter so far as to remark, that if a body were supposed to fall towards the centre of the earth, it would be retarded by the attraction of the part through which it had already fallen.§ Galileo had not altogether neglected to speculate on such a supposition, as is plain from the following extract. It is taken from a letter to Carcaville, dated from Arcetri, in 1637. "I will say farther, that I have not absolutely and clearly satisfied myself that a heavy body would arrive sooner at the centre of the earth, if it began to fall from the distance only of a single yard, than another which should start from the distance of a thousand miles. I do not affirm this, but I offer it as a paradox." ¶

It is very difficult to offer any satisfactory comment upon this passage; it may be sufficient to observe that this paradoxical result was afterwards de-

* Astronomia Nova. Pragæ. 1609.
† The new Planet no Planet, or the Earth no wandering Star, except in the wandering heads of Galileans. London, 1646.

* Aristarchi Samii de Mundi Systemate. Parisiis 1644.
† See page 12.
‡ De Cœlo, lib. iv. cap. 3.
§ Reflexiones Physico-Mathematicæ. Parisiis, 1647.
¶ Venturi.

duced by Newton, as one of the consequences of the general law with which all nature is pervaded, but with which there is no reason to believe that Galileo had any acquaintance; indeed the idea is fully negatived by other passages in this same letter. This is one of the many instances from which we may learn to be cautious how we invest detached passages of the earlier mathematicians with a meaning which in many cases their authors did not contemplate. The progressive development of these ideas in the hands of Wallis, Huyghens, Hook, Wren, and Newton, would lead us too far from our principal subject. There is another passage in the third dialogue connected with this subject, which it may be as well to notice in this place. " The parts of the earth have such a propensity to its centre, that when it changes its place, although they may be very distant from the globe at the time of the change, yet must they follow. An example similar to this is the perpetual sequence of the Medicean stars, although always separated from Jupiter. The same may be said of the moon, obliged to follow the earth. And this may serve for those simple ones who have difficulty in comprehending how these two globes, not being chained together, nor strung upon a pole, mutually follow each other, so that on the acceleration or retardation of the one, the other also moves quicker or slower."

The second Dialogue is appropriated chiefly to the discussion of the diurnal motion of the earth; and the principal arguments urged by Aristotle, Ptolemy, and others, are successively brought forward and confuted. The opposers of the earth's diurnal motion maintained, that if it were turning round, a stone dropped from the top of a tower would not fall at its foot; but, by the rotation of the earth to the eastward carrying away the tower with it, would be left at a great distance to the westward; it was common to compare this effect to a stone dropped from the mast-head of a ship, and without any regard to truth it was boldly asserted that this would fall considerably nearer the stern than the foot of the mast, if the ship were in rapid motion. The same argument was presented in a variety of forms,—such as that a cannon-ball shot perpendicularly upwards would not fall at the same spot; that if fired to the eastward it would fly farther than to the westward; that a mark to the east or west would never be hit, because of the rising or sinking of the horizon during the flight of the ball; that ladies ringlets would all stand out to the westward,* with other conceits of the like nature: to which the general reply is given, that in all these cases the stone, or ball, or other body, participates equally in the motion of the earth, which, therefore, so far as regards the relative motion of its parts, may be disregarded. The manner in which this is illustrated, appears in the following extract from the dialogue:—*Sagredo.* If the nib of a writing pen which was in the ship during my voyage direct from Venice to Alexandria, had had the power of leaving a visible mark of all its path, what trace, what mark, what line would it have left?—"*Simplicio.* It would have left a line stretched out thither from Venice not perfectly straight, or to speak more correctly, not perfectly extended in an exact circular arc, but here and there more and less curved accordingly as the vessel had pitched more or less; but this variation in some places of one or two yards to the right or left, or up or down in a length of many hundred miles, would have occasioned but slight alteration in the whole course of the line, so that it would have been hardly sensible, and without any great error we may speak of it as a perfectly circular arc.—*Sagred.* So that the true and most exact motion of the point of the pen would also have been a perfect arc of a circle if the motion of the vessel, abstracting from the fluctuations of the waves, had been steady and gentle; and if I had held this pen constantly in my hand, and had merely moved it an inch or two one way or the other, what alteration would that have made in the true and principal motion?—*Simpl.* Less than that which would be occasioned in a line a thousand yards long, by varying here and there from perfect straightness by the quantity of a flea's eye.—*Sagred.* If then a painter on our quitting the port had begun to draw with this pen on paper, and had continued his drawing till we got to Alexandria, he would have been able by its motion, to produce an accurate representation of many objects perfectly shadowed, and filled up on all sides with landscapes, buildings, and animals, although all the true, real, and essential motion of the point of his pen would have been no other but a very

* Riccioli.

long and very simple line; and as to the peculiar work of the painter, he would have drawn it exactly the same if the ship had stood still. Therefore, of the very protracted motion of the pen, there remain no other traces than those marks drawn upon the paper, the reason of this being that the great motion from Venice to Alexandria was common to the paper, the pen, and everything that was in the ship; but the trifling motion forwards and backwards, to the right and left, communicated by the painter's fingers to the pen, and not to the paper, from being peculiar to the pen, left its mark upon the paper, which as to this motion was immoveable. Thus it is likewise true that in the supposition of the earth's rotation, the motion of a falling stone is really a long track of many hundreds and thousands of yards; and if it could have delineated its course in the calm air, or on any other surface, it would have left behind it a very long transversal line; but that part of all this motion which is common to the stone, the tower, and ourselves, is imperceptible by us and the same as if not existing, and only that part remains to be observed of which neither we nor the tower partake, which in short is the fall of the stone along the tower."

The mechanical doctrines introduced into this second dialogue will be noticed on another occasion; we shall pass on to other extracts, illustrative of the general character of Galileo's reasoning:—"*Salviati.* I did not say that the earth has no principle, either internal or external, of its motion of rotation, but I do say that I know not which of the two it has, and that my ignorance has no power to take its motion away; but if this author knows by what principle other mundane bodies, of the motion of which we are certain, are turned round, I say that what moves the Earth is something like that by which Mars and Jupiter, and, as he believes, the starry sphere, are moved round; and if he will satisfy me as to the cause of their motion, I bind myself to be able to tell him what moves the earth. Nay more; I undertake to do the same if he can teach me what it is which moves the parts of the earth downwards.—*Simpl.* The cause of this effect is notorious, and every one knows that it is Gravity.—*Salv.* You are out, Master Simplicio; you should say that every one knows that it is called Gravity; but I do not ask you the name but the nature of the thing, of which nature you do not know one tittle more than you know of the nature of the moving cause of the rotation of the stars, except it be the name which has been given to the one, and made familiar and domestic, by the frequent experience we have of it many thousand times in a day; but of the principle or virtue by which a stone falls to the ground, we really know no more than we know of the principle which carries it upwards when thrown into the air, or which carries the moon round its orbit, except, as I have said, the name of gravity which we have peculiarly and exclusively assigned to it; whereas we speak of the other with a more generic term, and talk of the virtue impressed, and call it either an assisting or an informing intelligence, and are content to say that Nature is the cause of an infinite number of other motions."

Simplicio is made to quote a passage from Scheiner's book of Conclusions against Copernicus, to the following effect:—"'If the whole earth and water were annihilated, no hail or rain would fall from the clouds, but would only be naturally carried round in a circle, nor would any fire or fiery thing ascend, since, according to the not improbable opinion of these others, there is no fire in the upper regions.'—*Salv.* The foresight of this philosopher is most admirable and praiseworthy, for he is not content with providing for things that might happen during the common course of nature, but persists in shewing his care for the consequences of what he very well knows will never come to pass. Nevertheless, for the sake of hearing some of his notable conceits, I will grant that if the earth and water were annihilated there would be no more hail or rain, nor would fiery matter ascend any more, but would continue a motion of revolution. What is to follow? What conclusion is the philosopher going to draw?—*Simpl.* This objection is in the very next words—'Which nevertheless (says he) is contrary to experience and reason.'—*Salv.* Now I must yield: since he has so great an advantage over me as experience, with which I am quite unprovided. For hitherto I have never happened to see the terrestial earth and water annihilated, so as to be able to observe what the hail and fire did in the confusion. But does he tell us for our information at least what they did?—*Simp.* No, he does not say any thing more.—

*Salv.* I would give something to have a word or two with this person, to ask him whether, when this globe vanished, it also carried away the common centre of gravity, as I fancy it did, in which case I take it that the hail and water would remain stupid and confounded amongst the clouds, without knowing what to do with themselves. . . . And lastly, that I may give this philosopher a less equivocal answer, I tell him that I know as much of what would follow after the annihilation of the terrestrial globe, as he could have known what was about to happen in and about it, before it was created."

Great part of the third Dialogue is taken up with discussions on the parallax of the new stars of 1572 and 1604, in which Delambre notices that Galileo does not employ logarithms in his calculations, although their use had been known since Napier discovered them in 1616: the dialogue then turns to the annual motion "first taken from the Sun and conferred upon the Earth by Aristarchus Samius, and afterwards by Copernicus." Salviati speaks of his contemporary philosophers with great contempt—"If you had ever been worn out as I have been many and many a time with hearing what sort of stuff is sufficient to make the obstinate vulgar unpersuadable, I do not say to agree with, but even to listen to these novelties, I believe your wonder at finding so few followers of these opinions would greatly fall off. But little regard in my judgment is to be had of those understandings who are convinced and immoveably persuaded of the fixedness of the earth, by seeing that they are not able to breakfast this morning at Constantinople, and sup in the evening in Japan, and who feel satisfied that the earth, so heavy as it is, cannot climb up above the sun, and then come tumbling in a breakneck fashion down again!"* This remark serves to introduce several specious arguments against the annual motion of the earth, which are successively confuted, and it is shewn how readily the apparent stations and retrogradations of the planets are accounted for on this supposition.

The following is one of the frequently recurring passages in which Galileo, whilst arguing in favour of the enormous distances at which the theory of Copernicus necessarily placed the fixed stars, inveighs against the arrogance with which men pretend to judge of matters removed above their comprehension. "*Simpl.* All this is very well, and it is not to be denied that the heavens may surpass in bigness the capacity of our imaginations, as also that God might have created it yet a thousand times larger than it really is, but we ought not to admit anything to be created in vain, and useless in the universe. Now whilst we see this beautiful arrangement of the planets, disposed round the earth at distances proportioned to the effects they are to produce on us for our benefit, to what purpose should a vast vacancy be afterwards interposed between the orbit of Saturn and the starry spheres, containing not a single star, and altogether useless and unprofitable? to what end? for whose use and advantage?—*Salv.* Methinks we arrogate too much to ourselves, Simplicio, when we will have it that the care of us alone is the adequate and sufficient work and bound, beyond which the divine wisdom and power does and disposes of nothing. I feel confident that nothing is omitted by the Divine Providence of what concerns the government of human affairs; but that there may not be other things in the universe dependant upon His supreme wisdom, I cannot for myself, by what my reason holds out to me, bring myself to believe. So that when I am told of the uselessness of an immense space interposed between the orbits of the planets and the fixed stars, empty and valueless, I reply that there is temerity in attempting by feeble reason to judge the works of God, and in calling vain and superfluous every part of the universe which is of no use to us.—*Sagr.* Say rather, and I believe you would say better, that we have no means of knowing what is of use to us; and I hold it to be one of the greatest pieces of arrogance and folly that can be in this world to say, because I know not of what use Jupiter or Saturn are to me, that therefore these planets are superfluous; nay, more, that there are no such things in nature. To understand what effect is worked upon us by this or that heavenly body (since you will have it that all their use must have a reference to us), it would be necessary to remove it for a

* The notions commonly entertained of 'up' and 'down,' as connected with the observer's own situation, had long been a stumbling-block in the way of the new doctrines. When Columbus held out the certainty of arriving in India by sailing to the westward on account of the earth's roundness, it was gravely objected, that it might be well enough to sail down to India, but that the chief difficulty would consist in climbing up back again.

while, and then the effect which I find no longer produced in me, I may say that it depended upon that star. Besides, who will dare say that the space which they call too vast and useless between Saturn and the fixed stars is void of other bodies belonging to the universe. Must it be so because we do not see them: then I suppose the four Medicean planets, and the companions of Saturn, came into the heavens when we first began to see them, and not before! and, by the same rule, the other innumerable fixed stars did not exist before men saw them. The nebulæ were till lately only white flakes, till with the telescope we have made of them constellations of bright and beautiful stars. Oh presumptuous! rather, Oh rash ignorance of man!"

After a discussion on Gilbert's Theory of Terrestrial Magnetism, introduced by the parallelism of the earth's axis, and of which Galileo praises very highly both the method and results, the dialogue proceeds as follows:—"*Simpl.* It appears to me that Sig. Salviati, with a fine circumlocution, has so clearly explained the cause of these effects, that any common understanding, even though unacquainted with science, may comprehend it: but we, confining ourselves to the terms of art, reduce the cause of these and other similar natural phenomena to sympathy, which is a certain agreement and mutual appetency arising between things which have the same qualities, just as, on the other hand, that disagreement and aversion, with which other things naturally repel and abhor each other, we style antipathy.—*Sagr.* And thus with these two words they are able to give a reason for the great number of effects and accidents which we see, not without admiration, to be produced in Nature. But it strikes me that this mode of philosophising has a great sympathy with the style in which one of my friends used to paint: on one part of the canvas he would write with chalk—there I will have a fountain, with Diana and her nymphs; here some harriers; in this corner I will have a huntsman, with a stag's head; the rest may be a landscape of wood and mountain; and what remains to be done may be put in by the colourman: and thus he flattered himself that he had painted the story of Actæon, having contributed nothing to it beyond the names."

The fourth Dialogue is devoted entirely to an examination of the tides, and is a development and extension of the treatise already mentioned to have been sent to the Archduke Leopold, in 1618*. Galileo was uncommonly partial to his theory of the tides, from which he thought to derive a direct proof of the earth's motion in her orbit; and although his theory was erroneous, it required a farther advance in the science of motion than had been attained even at a much later period to point out the insufficiency of it. It is well known that the problem of explaining the cause of this alternate motion of the waters had been considered from the earliest ages one of the most difficult that could be proposed, and the solutions with which different inquirers were obliged to rest contented, shew that it long deserved the name given to it, of "the grave of human curiosity†." Riccioli has enumerated several of the opinions which in turn had their favourers and supporters. One party supposed the rise of the waters to be occasioned by the influx of rivers into the sea; others compared the earth to a large animal, of which the tides indicated the respiration; a third theory supposed the existence of subterraneous fires, by which the sea was periodically made to boil; others attributed the cause of a similar change of temperature to the sun and moon.

There is an unfounded legend, that Aristotle drowned himself in despair of being able to invent a plausible explanation of the extraordinary tides in the Euripus. His curiosity on the subject does not appear to have been so acute (judging from his writings) as this story would imply. In one of his books he merely mentions a rumour, that there are great elevations or swellings of the seas, which recur periodically, according to the course of the moon. Lalande, in the fourth volume of his Astronomy, has given an interesting account of the opinion of the connection of the tides with the moon's motion. Pytheas of Marseilles, a contemporary of Aristotle, was the first who has been recorded as observing, that the full tides occur at full moon, and the ebbs at new moon‡. This is not quite correctly stated; for the tide of new moon is known to be still higher than the rise at the full, but it is likely enough, that the seeming inaccuracy should be attributed, not to

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* See page 50. † Riccioli Almag. Nov.
‡ Plutarch. De placit. Philos. lib. iii. c. 17.

Pytheas, but to his biographer Plutarch, who, in many instances, appears to have viewed the opinions of the old philosophers through the mist of his own prejudices and imperfect information. The fact is, that, on the same day when the tide rises highest, it also ebbs lowest; and Pytheas, who, according to Pliny, had recorded a tide in Britain of eighty cubits, could not have been ignorant of this. Posidonius, as quoted by Strabo, maintained the existence of three periods of the tide, daily, monthly, and annual, " in sympathy with the moon." * Pliny, in his vast collection of natural observations, not unaptly styled the Encyclopædia of the Antients, has the following curious passages:— " The flow and ebb of the tide is very wonderful; it happens in a variety of ways, but the cause is in the sun and moon†." He then very accurately describes the course of the tide during a revolution of the moon, and adds: " The flow takes place every day at a different hour; being waited on by the star, which rises every day in a different place from that of the day before, and with greedy draught drags the seas with it‡." " When the moon is in the north, and further removed from the earth, the tides are more gentle than when digressing to the south, she exerts her force with a closer effort§."

The College of Jesuits at Coimbra appears to deserve the credit of first clearly pointing out the true relation between the tides and the moon, which was also maintained a few years later by Antonio de Dominis and Kepler. In the Society's commentary on Aristotle's book on Meteors, after refuting the notion that the tides are caused by the light of the sun and moon, they say, " It appears more probable to us, without any rarefaction, of which there appears no need or indication, that the moon raises the waters by some inherent power of impulsion, in the same manner as a magnet moves iron; and according to its different aspects and approaches to the sea, and the obtuse or acute angles of its bearing, at one time to attract and raise the waters along the shore, and then again to leave them to sink down by their own weight, and to gather into a lower level.*" The theory of Universal Gravitation seems here within the grasp of these philosophers, but unfortunately it did not occur to them that possibly the same attraction might be exerted on the earth as well as the water, and that the tide was merely an effect of the diminution of force, owing to the increase of distance, with which the centre of the earth is attracted, as compared with that exerted on its surface. This idea, so happily seized afterwards by Newton, might at once have furnished them with a satisfactory explanation of the tide, which is observed on the opposite side of the earth as well as immediately under the moon. They might have seen that in the latter case the centre of the earth is pulled away from the water, just as in the former the water is pulled away from the centre of the earth, the sensible effect to us being in both cases precisely the same. For want of this generalization, the inferior tide as it is called presented a formidable obstacle to this theory, and the most plausible explanation that was given was, that this magnetic virtue radiated out from the moon was reflected by the solid heavens, and concentrated again as in a focus on the opposite side of the earth. The majority of modern astronomers who did not admit the existence of any solid matter fit for producing the effect assigned to it, found a reasonable difficulty in acquiescing in this explanation. Galileo, who mentions the Archbishop of Spalatro's book, treated the theory of attraction by the moon as absurd. " This motion of the seas is local and sensible, made in an immense mass of water, and cannot be brought to obey light, and warmth, and predominancy of occult qualities, and such like vain fancies; all which are so far from being the cause of the tide, that on the contrary the tide is the cause of them, inasmuch as it gives rise to these ideas in brains which are more apt for talkativeness and ostentation, than for speculation and inquiry into the secrets of Nature; who, rather than see themselves driven to pronounce these wise, ingenuous, and modest words—*I do not know*,—will blurt out from their tongues and pens all sorts of extravagancies."

Galileo's own theory is introduced by the following illustration, which indeed

* *συμπαθεως τη σεληνη*. Geographiæ, lib. iii.

† Historia Naturalis, lib. ii. c. 97.

‡ Ut ancillante sidere, trahenteque secum avido haustu maria.

§ Eâdem Aquiloniâ, et à terris longius recedente, mitiores quam cum, in Austros digressâ, propiore nisu vim suam exercet.

* Commentarii Collegii Conimbricensis. Coloniæ, 1603.

probably suggested it, as he was in the habit of suffering no natural phenomena, however trivial in appearance, to escape him. He felt the advantage of this custom in being furnished on all occasions with a stock of homely illustrations, to which the daily experience of his hearers readily assented, and which he could shew to be identical in principle with the phenomena under discussion. That he was mistaken in applying his observations in the present instance cannot be urged against the incalculable value of such a habit.

"We may explain and render sensible these effects by the example of one of those barks which come continually from Lizza Fusina, with fresh water for the use of the city of Venice. Let us suppose one of these barks to come thence with moderate velocity along the canal, carrying gently the water with which it is filled, and then, either by touching the bottom, or from some other hindrance which is opposed to it, let it be notably retarded; the water will not on that account lose like the bark the impetus it has already acquired, but will forthwith run on towards the prow where it will sensibly rise, and be depressed at the stern. If on the contrary the said vessel in the middle of its steady course shall receive a new and sensible increase of velocity, the contained water before giving into it will persevere for some time in its slowness, and will be left behind that is to say towards the stern where consequently it will rise, and sink at the head.—Now, my masters, that which the vessel does in respect of the water contained in it, and that which the water does in respect of the vessel containing it, is the same to a hair as what the Mediterranean vase does in respect of the water which it contains, and that the waters do in respect of the Mediterranean vase which contains them. We have now only to demonstrate how, and in what manner it is true that the Mediterranean, and all other gulfs, and in short all the parts of the earth move with a motion sensibly not uniform, although no motion results thence to the whole globe which is not perfectly uniform and regular."

This unequable motion is derived from a combination of the earth's motion on her axis, and in her orbit, the consequence of which is that a point under the sun is carried in the same direction by the annual and diurnal velocities, whereas a point on the opposite side of the globe is carried in opposite directions by the annual and diurnal motions, so that in every twenty-four hours the absolute motion through space of every point in the earth completes a cycle of varying swiftness. Those readers who are unacquainted with the mathematical theory of motion must be satisfied with the assurance that this specious representation is fallacious, and that the oscillation of the water does not in the least result from the causes here assigned to it: the reasoning necessary to prove this is not elementary enough to be introduced here with propriety.

Besides the principal daily oscillation of the water, there is a monthly inequality in the rise and fall, of which the extremes are called the spring and neap tides: the manner in which Galileo attempted to bring his theory to bear upon these phenomena is exceedingly curious.

"It is a natural and necessary truth, that if a body be made to revolve, the time of revolution will be greater in a greater circle than in a less: this is universally allowed, and fully confirmed by experiments, such for instance as these:—In wheel clocks, especially in large ones, to regulate the going, the workmen fit up a bar capable of revolving horizontally, and fasten two leaden weights to the ends of it; and if the clock goes too slow, by merely approaching these weights somewhat towards the centre of the bar, they make its vibrations more frequent, at which time they are moving in smaller circles than before*.—Or, if you fasten a weight to a cord which you pass round a pulley in the ceiling, and whilst the weight is vibrating draw in the cord towards you, the vibrations will become sensibly accelerated as the length of the string diminishes. We may observe the same rule to hold among the celestial motions of the planets, of which we have a ready instance in the Medicean planets, which revolve in such short periods round Jupiter. We may therefore safely conclude, that if the moon for instance shall continue to be forced round by the same moving power, and were to move in a smaller circle, it would shorten the time of its revolution. Now this very thing happens in fact to the moon, which I have just advanced on a supposition. Let us call

* See fig. 1. p. 96.

to mind that we have already concluded with Copernicus, that it is impossible to separate the moon from the earth, round which without doubt it moves in a month: we must also remember that the globe of the earth, accompanied always by the moon, revolves in the great circle round the sun in a year, in which time the moon revolves round the earth about thirteen times, whence it follows that the moon is sometimes near the sun, that is to say between the earth and sun, sometimes far from it, when she is on the outside of the earth. Now if it be true that the power which moves the earth and the moon round the sun remains of the same efficacy, and if it be true that the same moveable, acted on by the same force, passes over similar arcs of circles in a time which is least when the circle is smallest, we are forced to the conclusion that at new moon, when in conjunction with the sun, the moon passes over greater arcs of the orbit round the sun, than when in opposition at full moon; and this inequality of the moon will be shared by the earth also. So that exactly the same thing happens as in the balance of the clocks; for the moon here represents the leaden weight, which at one time is fixed at a greater distance from the centre to make the vibrations slower, and at another time nearer to accelerate them."

Wallis adopted and improved this theory in a paper which he inserted in the Philosophical Transactions for 1666, in which he declares, that the circular motion round the sun should be considered as taking place at a point which is the centre of gravity of the earth and moon. "To the first objection, that it appears not how two bodies that have no tie can have one common centre of gravity, I shall only answer, that it is harder to show how they have it, than that they have it*." As Wallis was perfectly competent from the time at which he lived, and his knowledge of the farthest advances of science in his time, to appreciate the value of Galileo's writings, we shall conclude this chapter with the judgment that he has passed upon them in the same paper. "Since Galileo, and after him Torricelli and others have applied mechanical principles to the solving of philosophical difficulties, natural philosophy is well known to have been rendered more intelligible, and to have made a much greater progress in less than a hundred years than before for many ages."

* Phil. Trans., No. 16, August 1666.

## Chapter XV.

*Galileo at Arcetri—Becomes Blind—Moon's Libration—Publication of the Dialogues on Motion.*

We have already alluded to the imperfect state of the knowledge possessed with regard to Galileo's domestic life and personal habits; there is reason however to think that unpublished materials exist from which these outlines might be in part filled up. Venturi informs us that he had seen in the collection from which he derived a great part of the substance of his Memoirs of Galileo, about one hundred and twenty manuscript letters, dated between the years 1623 and 1633, addressed to him by his daughter Maria, who with her sister had attached herself to the convent of St. Matthew, close to Galileo's usual place of residence. It is difficult not to think that much interesting information might be obtained from these, with respect to Galileo's domestic character. The very few published extracts confirm our favourable impressions of it, and convey a pleasing idea of this his favourite daughter. Even when, in her affectionate eagerness to soothe her father's wounded feelings at the close of his imprisonment in Rome, she dwells with delight upon her hopes of being allowed to relieve him, by taking on herself the penitential recitations which formed a part of his sentence, the prevalent feeling excited in every one by the perusal must surely be sympathy with the filial tenderness which it is impossible to misunderstand.

The joy she had anticipated in again meeting her parent, and in compensating to him by her attentive affection the insults of his malignant enemies, was destined to be but of short duration. Almost in the same month in which Galileo returned to Arcetri she was seized with a fatal illness; and already in the beginning of April, 1634, we learn her death from the fruitless condolence of his friends. He was deeply and bitterly affected by this additional blow, which came upon him when he was himself in a weak and declining state of health, and his answers breathe a spirit of the most hopeless and gloomy despondency.

In a letter written in April to Boc-

chineri, his son's father-in-law, he says: "The hernia has returned worse than at first: my pulse is intermitting, accompanied with a palpitation of the heart; an immeasurable sadness and melancholy; an entire loss of appetite; I am hateful to myself; and in short I feel that I am called incessantly by my dear daughter. In this state, I do not think it advisable that Vincenzo should set out on his journey, and leave me, when every hour something may occur, which would make it expedient that he should be here." In this extremity of ill health, Galileo requested leave to go to Florence for the advantage of medical assistance; but far from obtaining permission, it was intimated that any additional importunities would be noticed by depriving him of the partial liberty he was then allowed to enjoy. After several years confinement at Arcetri, during the whole of which time he suffered from continual indisposition, the inquisitor Fariano wrote to him in 1638, that the Pope permitted his removal to Florence, for the purpose of recovering his health; requiring him at the same time to present himself at the Office of the Inquisition, where he would learn the conditions on which this favour had been granted. These were that he should neither quit his house nor receive his friends there; and so closely was the letter of these instructions adhered to, that he was obliged to obtain a special permission to go out to attend mass during Passion week. The strictness with which all personal intercourse with his friends was interrupted, is manifest from the result of the following letter from the Duke of Tuscany's secretary of state to Nicolini, his ambassador at Rome. "Signor Galileo Galilei, from his great age and the illnesses which afflict him, is in a condition soon to go to another world; and although in this the eternal memory of his fame and value is already secured, yet his Highness is greatly desirous that the world should sustain as little loss as possible by his death; that his labours may not perish, but for the public good may be brought to that perfection which he will not be able to give them. He has in his thoughts many things worthy of him, which he cannot be prevailed on to communicate to any but Father Benedetto Castelli, in whom he has entire confidence. His Highness wishes therefore that you should see Castelli, and induce him to procure leave to come to Florence for a few months for this purpose, which his Highness has very much at heart; and if he obtains permission, as his Highness hopes, you will furnish him with money and every thing else he may require for his journey." Castelli, it will be remembered, was at this time salaried by the court of Rome. Nicolini answered that Castelli had been himself to the Pope to ask leave to go to Florence. Urban immediately intimated his suspicions that his design was to see Galileo, and upon Castelli's stating that certainly it would be impossible for him to refrain from attempting to see him, he received permission to visit him in the company of an officer of the Inquisition. At the end of some months Galileo was remanded to Arcetri, which he never again quitted.

In addition to his other infirmities, a disorder which some years before had affected the sight of his right eye returned in 1636; in the course of the ensuing year the other eye began to fail also, and in a few months he became totally blind. It would be difficult to find any even among those who are the most careless to make a proper use of the invaluable blessing of sight, who could bear unmoved to be deprived of it, but on Galileo the loss fell with peculiar and terrible severity; on him who had boasted that he would never cease from using the senses which God had given him, in declaring the glory of his works, and the business of whose life had been the splendid fulfilment of that undertaking. "The noblest eye is darkened," said Castelli, "which nature ever made: an eye so privileged, and gifted with such rare qualities, that it may with truth be said to have seen more than all of those who are gone, and to have opened the eyes of all who are to come." His own patience and resignation under this fatal calamity are truly wonderful; and if occasionally a word of complaint escaped him, it was in the chastened tone of the following expressions—"Alas! your dear friend and servant Galileo has become totally and irreparably blind; so that this heaven, this earth, this universe, which with wonderful observations I had enlarged a hundred and thousand times beyond the belief of by-gone ages, henceforward for me is shrunk into the narrow space which I myself fill in it.—So it pleases God: it shall therefore please me also." Hopes were at first enter-

tained by Galileo's friends, that the blindness was occasioned by cataracts, and that he might look forward to relief from the operation of couching; but it very soon appeared that the disorder was not in the humours of the eye, but in a cloudiness of the cornea, the symptoms of which all external remedies failed to alleviate.

As long as the power was left him, he had indefatigably continued his astronomical observations. Just before his sight began to decay, he had observed a new phenomenon in the moon, which is now known by the name of the moon's libration, the nature of which we will shortly explain. A remarkable circumstance connected with the moon's motion is, that the same side is always visible from the earth, showing that the moon turns once on her own axis in exactly the time of her monthly revolution.* But Galileo, who was by this time familiar with the whole of the moon's visible surface, observed that the above-mentioned effect does not accurately take place, but that a small part on either side comes alternately forward into sight, and then again recedes, according to the moon's various positions in the heavens. He was not long in detecting one of the causes of this apparent libratory or rocking motion. It is partly occasioned by our distance as spectators from the centre of the earth, which is also the centre of the moon's motion. In consequence of this, as the moon rises in the sky we get an additional view of the lower half, and lose sight of a small part of the upper half which was visible to us while we were looking down upon her when low in the horizon. The other cause is not quite so simple, nor is it so certain that Galileo adverted to it: it is however readily intelligible even to those who are unacquainted with astronomy, if they will receive as a fact that the monthly motion of the moon is not uniform, but that she moves quicker at one time than another, whilst the motion of rotation on her own axis, like that of the earth, is perfectly uniform. A very little reflection will show that the observed phenomenon will necessarily follow. If the moon did not turn on her axis, every side of her would be successively presented, in the course of a month, towards the earth; it is the motion of rotation which tends to carry the newly discovered parts out of sight.

Let us suppose the moon to be in that part of her orbit where she moves with her average motion, and that she is moving towards the part where she moves most quickly. If the motion in the orbit were to remain the same all the way round, the motion of rotation would be just sufficient at every point to bring round the same part of the moon directly in front of the earth. But since, from the supposed point, the moon is moving for some time round the earth with a motion continually growing quicker, the motion of rotation is not sufficiently quick to carry out of sight the entire part discovered by the motion of translation. We therefore get a glimpse of a narrow strip on the side *from* which the moon is moving, which strip grows broader and broader, till she passes the point where she moves most swiftly, and reaches the point of average swiftness on the opposite side of her orbit. Her motion is now continually growing slower, and therefore from this point the motion of rotation is too swift, and carries too much out of sight, or in other words, brings into sight a strip on the side *towards* which the moon is moving. This increases till she passes the point of least swiftness, and arrives at the point from which we began to trace her course, and the phenomena are repeated in the same order.

This interesting observation closes the long list of Galileo's discoveries in the heavens. After his abjuration, he ostensibly withdrew himself in a great measure from his astronomical pursuits, and employed himself till 1636 principally with his Dialogues on Motion, the last work of consequence that he published. In that year he entered into correspondence with the Elzevirs, through his friend Micanzio, on the project of printing a complete edition of his writings. Among the letters which Micanzio wrote on the subject is one intimating that he had enjoyed the gratification, in his quality of Theologian to the Republic of Venice, of refusing his sanction to a work written against Galileo and Copernicus. The temper however in which this refusal was an-

* Frisi says that Galileo did not perceive this conclusion (Elogio del Galileo); but see The Dial. on the System, Dial. I. pp. 61, 62, 85. Edit. 1744. Plutarch says, (De Placitis Philos. lib. ii. c. 28,) that the Pythagoreans believed the moon to have inhabitants fifteen times as large as men, and that their day is fifteen times as long as ours. It seems probable, that the former of these opinions was engrafted on the latter, which is true, and implies a perception of the fact in the text.

nounced, contrasts singularly with that of the Roman Inquisitors. "A book was brought to me which a Veronese Capuchin has been writing, and wished to print, denying the motion of the earth. I was inclined to let it go, to make the world laugh, for the ignorant beast entitles every one of the twelve arguments which compose his book, 'An irrefragable and undeniable demonstration,' and then adduces nothing but such childish trash as every man of sense has long discarded. For instance, this poor animal understands so much geometry and mathematics, that he brings forward as a demonstration, that if the earth could move, having nothing to support it, it must necessarily fall. He ought to have added that then we should catch all the quails. But when I saw that he speaks indecently of you, and has had the impudence to put down an account of what passed lately, saying that he is in possession of the whole of your process and sentence, I desired the man who brought it to me to go and be hanged. But you know the ingenuity of impertinence; I suspect he will succeed elsewhere, because he is so enamoured of his absurdities, that he believes them more firmly than his Bible."

After Galileo's condemnation at Rome, he had been placed by the Inquisition in the list of authors the whole of whose writings, '*edita et edenda*,' were strictly forbidden. Micanzio could not even obtain permission to reprint the Essay on Floating Bodies, in spite of his protestations that it did not in any way relate to the Copernican theory. This was the greatest stigma with which the Inquisition were in the habit of branding obnoxious authors; and, in consequence of it, when Galileo had completed his Dialogues on Motion, he found great difficulty in contriving their publication, the nature of which may be learned from the account which Pieroni sent to Galileo of his endeavours to print them in Germany. He first took the manuscript to Vienna, but found that every book printed there must receive the approbation of the Jesuits; and Galileo's old antagonist, Scheiner, happening to be in that city, Pieroni feared lest he should interfere to prevent the publication altogether, if the knowledge of it should reach him. Through the intervention of Cardinal Dietrichstein, he therefore got permission to have it printed at Olmutz, and that it should be approved by a Dominican, so as to keep the whole business a secret from Scheiner and his party; but during this negociation the Cardinal suddenly died, and Pieroni being besides dissatisfied with the Olmutz type, carried back the manuscript to Vienna, from which he heard that Scheiner had gone into Silesia. A new approbation was there procured, and the work was just on the point of being sent to press, when the dreaded Scheiner re-appeared in Vienna, on which Pieroni again thought it advisable to suspend the impression till his departure. In the mean time his own duty as a military architect in the Emperor's service carried him to Prague, where Cardinal Harrach, on a former occasion, had offered him the use of the newly-erected University press. But Harrach happened not to be at Prague, and this plan like the rest became abortive. In the meantime Galileo, wearied with these delays, had engaged with Louis Elzevir, who undertook to print the Dialogues at Amsterdam.

It is abundantly evident from Galileo's correspondence that this edition was printed with his full concurrence, although, in order to obviate further annoyance, he pretended that it was pirated from a manuscript copy which he sent into France to the Comte de Noailles, to whom the work is dedicated. The same dissimulation had been previously thought necessary, on occasion of the Latin translation of "The Dialogues on the System," by Bernegger, which Galileo expressly requested through his friend Deodati, and of which he more than once privately signified his approbation, presenting the translator with a valuable telescope, although he publicly protested against its appearance. The story which Bernegger introduced in his preface, tending to exculpate Galileo from any share in the publication, is by his own confession a mere fiction. Noailles had been ambassador at Rome, and, by his conduct there, well deserved the compliment which Galileo paid him on the present occasion.

As an introduction to the account of this work, which Galileo considered the best he had ever produced, it will become necessary to premise a slight sketch of the nature of the mechanical philosophy which he found prevailing, nearly as it had been delivered by Aristotle, with the same view with which we introduced specimens of the astronomical opinions current when Galileo began to write on that subject: they serve to show the nature

and objects of the reasoning which he had to oppose; and, without some exposition of them, the aim and value of many of his arguments would be imperfectly understood and appreciated.

## Chapter XVI.

### *State of the Science of Motion before Galileo.*

It is generally difficult to trace any branch of human knowledge up to its origin, and more especially when, as in the case of mechanics, it is very closely connected with the immediate wants of mankind. Little has been told to us when we are informed that so soon as a man might wish to remove a heavy stone, "he would be led, by natural instinct, to slide under it the end of some long instrument, and that the same instinct would teach him either to raise the further end, or to press it downwards, so as to turn round upon some support placed as near to the stone as possible*."

Montucla's history would have lost nothing in value, if, omitting "this philosophical view of the birth of the art," he had contented himself with his previous remark, that there can be little doubt that men were familiar with the use of mechanical contrivances long before the idea occurred of enumerating or describing them, or even of examining very closely the nature and limits of the aid they are capable of affording. The most careless observer indeed could scarcely overlook that the weights heaved up with a lever, or rolled along a slope into their intended places, reached them more slowly than those which the workmen could lift directly in their hands; but it probably needed a much longer time to enable them to see the exact relation which, in these and all other machines, exists between the increase of the power to move, and the decreasing swiftness of the thing moved.

In the preface to Galileo's Treatise on Mechanical Science, published in 1592, he is at some pains to set in a clear light the real advantages belonging to the use of machines, "which (says he) I have thought it necessary to do, because, if I mistake not, I see almost all mechanics deceiving themselves in the belief that, by the help of a machine, they can raise a greater weight than they are able to lift by the exertion of the same force without it.—Now if we take any determinate weight, and any force, and any distance whatever, it is beyond doubt that we can move the weight to that distance by means of that force; because even although the force may be exceedingly small, if we divide the weight into a number of fragments, each of which is not too much for our force, and carry these pieces one by one, at length we shall have removed the whole weight; nor can we reasonably say at the end of our work, that this great weight has been moved and carried away by a force less than itself, unless we add that the force has passed several times over the space through which the whole weight has gone but once. From which it appears that the velocity of the force (understanding by velocity the space gone through in a given time) has been as many times greater than that of the weight, as the weight is greater than the force: nor can we on that account say that a great force is overcome by a small one, contrary to nature: then only might we say that nature is overcome when a small force moves a great weight as swiftly as itself, which we assert to be absolutely impossible with any machine either already or hereafter to be contrived. But since it may occasionally happen that we have but a small force, and want to move a great weight without dividing it into pieces, then we must have recourse to a machine by means of which we shall remove the given weight, with the given force, through the required space. But nevertheless the force as before will have to travel over that very same space as many times repeated as the weight surpasses its power, so that, at the end of our work, we shall find that we have derived no other benefit from our machine than that we have carried away the same weight altogether, which if divided into pieces we could have carried without the machine, by the same force, through the same space, in the same time. This is one of the advantages of a machine, because it often happens that we have a lack of force but abundance of time, and that we wish to move great weights all at once."

This compensation of force and time has been fancifully personified by saying that Nature cannot be cheated, and in scientific treatises on mechanics, is called the "principle of virtual velocities," consisting in the theorem that two weights will balance each other on any

* Histoire des Mathématiques, vol. i. p. 97.

machine, no matter how complicated or intricate the connecting contrivances may be, when one weight bears to the other the same proportion that the space through which the latter would be raised bears to that through which the former would sink, in the first instant of their motion, if the machine were stirred by a third force. The whole theory of machines consists merely in generalizing and following out this principle into its consequences; combined, when the machines are in a state of motion, with another principle equally elementary, but to which our present subject does not lead us to allude more particularly.

The credit of making known the principle of virtual velocities is universally given to Galileo; and so far deservedly, that he undoubtedly perceived the importance of it, and by introducing it everywhere into his writings succeeded in recommending it to others; so that five and twenty years after his death, Borelli, who had been one of Galileo's pupils, calls it "that mechanical principle with which everybody is so familiar*," and from that time to the present it has continued to be taught as an elementary truth in most systems of mechanics. But although Galileo had the merit in this, as in so many other cases, of familiarizing and reconciling the world to the reception of truth, there are remarkable traces before his time of the employment of this same principle, some of which have been strangely disregarded. Lagrange asserts† that the ancients were entirely ignorant of the principle of virtual velocities, although Galileo, to whom he refers it, distinctly mentions that he himself found it in the writings of Aristotle. Montucla quotes a passage from Aristotle's Physics, in which the law is stated generally, but adds that he did not perceive its immediate application to the lever, and other machines. The passage to which Galileo alludes is in Aristotle's Mechanics, where, in discussing the properties of the lever, he says expressly, "the same force will raise a greater weight, in proportion as the force is applied at a greater distance from the fulcrum, and the reason, as I have already said, is because it describes a greater circle; and a weight which is farther removed from the centre is made to move through a greater space."‡

It is true, that in the last mentioned treatise, Aristotle has given other reasons which belong to a very different kind of philosophy, and which may lead us to doubt whether he fully saw the force of the one we have just quoted. It appeared to him not wonderful that so many mechanical paradoxes (as he called them) should be connected with circular motion, since the circle itself seemed of so paradoxical a nature. "For, in the first place, it is made up of an immoveable centre, and a moveable radius, qualities which are contrary to each other. 2dly. Its circumference is both convex and concave. 3dly. The motion by which it is described is both forward and backward, for the describing radius comes back to the place from which it started. 4thly. The radius is *one;* but every point of it moves in describing the circle with a different degree of swiftness."

Perhaps Aristotle may have borrowed the idea of virtual velocities, contrasting so strongly with his other physical notions, from some older writer; possibly from Archytas, who, we are told, was the first to reduce the science of mechanics to methodical order;* and who by the testimony of his countrymen was gifted with extraordinary talents, although none of his works have come down to us. The other principles and maxims of Aristotle's mechanical philosophy, which we shall have occasion to cite, are scattered through his books on Mechanics, on the Heavens, and in his Physical Lectures, and will therefore follow rather unconnectedly, though we have endeavoured to arrange them with as much regularity as possible.

After defining a body to be that which is divisible in every direction, Aristotle proceeds to inquire how it happens that a body has only the three dimensions of length, breadth, and thickness; and seems to think he has given a reason in saying that, when we speak of two things, we do not say "all," but "both," and three is the first number of which we say "all."† When he comes to speak of motion, he says, "If motion is not understood, we cannot but remain ignorant of Nature. Motion appears to be of the nature of continuous quantities, and in continuous quantity infinity first makes its appearance; so as to furnish some with a definition who say that con-

* De vi Percussionis. Bononiæ, 1667.
† Mec. Analyt.
‡ Mechanica.

* Diog. Laert. In vit. Archyt.
† De Cœlo, lib. i. c. 1.

tinuous quantity is that which is infinitely divisible.—Moreover, unless there be time, space, and a vacuum, it is impossible that there should be motion*."—Few propositions of Aristotle's physical philosophy are more notorious than his assertion that nature abhors a vacuum, on which account this last passage is the more remarkable, as he certainly did not go so far as to deny the existence of motion, and therefore asserts here the necessity of that of which he afterwards attempts to show the absurdity.—" Motion is the energy of what exists in power so far forth as so existing. It is that act of a moveable which belongs to its power of moving." † After struggling through such passages as the preceding we come at last to a resting-place.—" It is difficult to understand what motion is."—When the same question was once proposed to another Greek philosopher, he walked away, saying, " I cannot tell you, but I will show you;" an answer intrinsically worth more than all the subtleties of Aristotle, who was not humble-minded enough to discover that he was tasking his genius beyond the limits marked out for human comprehension.

He labours in the same manner and with the same success to vary the idea of space. He begins the next book with declaring, that " those who say there is a vacuum assert the existence of space; for a vacuum is space, in which there is no substance;" and after a long and tedious reasoning concludes that, " not only what space is, but also whether there be such a thing, cannot but be doubted."‡ Of time he is content to say merely, that " it is clear that time is not motion, but that without motion there would be no time;" § and there is perhaps little fault to be found with this remark, understanding motion in the general sense in which Aristotle here applies it, of every description of change.

Proceeding after these remarks on the nature of motion in general to the motion of bodies, we are told that " all local motion is either straight, circular, or compounded of these two; for these two are the only simple sorts of motion. Bodies are divided into simple and concrete; simple bodies are those which have naturally a principle of motion, as fire and earth, and their kinds. By simple motion is meant the motion of a simple body." * By these expressions Aristotle did not mean that a simple body cannot have what he calls a compound motion, but in that case he called the motion violent or unnatural; this division of motion into natural and violent runs through the whole of the mechanical philosophy founded upon his principles. " Circular motion is the only one which can be endless;"† the reason of which is given in another place: for " that cannot be doing, which cannot be done; and therefore it cannot be that a body should be moving towards a point (*i. e.* the end of an infinite straight line) whither no motion is sufficient to bring it." ‡ Bacon seems to have had these passages in view when he indulged in the reflections which we have quoted in page 14. " There are four kinds of motion of one thing by another: Drawing, Pushing, Carrying, Rolling. Of these, Carrying and Rolling may be referred to Drawing and Pushing.§—The prime mover and the thing moved are always in contact."

The principle of the composition of motions is stated very plainly: " when a moveable is urged in two directions with motions bearing any ratio to each other, it moves necessarily in a straight line, which is the diameter of the figure formed by drawing the two lines of direction in that ratio;"‖ and adds, in a singularly curious passage, " but when it is urged for any time with two motions which have an indefinitely small ratio one to another, the motion cannot be straight, so that a body describes a curve, when it is urged by two motions bearing an indefinitely small ratio one to another, and lasting an indefinitely small time." ¶

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* Phys. lib. i. c. 3.

† Lib. iii. c. 2. The Aristotelians distinguished between things as existing in act or energy (ενεργεια) and things in capacity or power (δυναμις). For the advantage of those who may think the distinction worth attending to, we give an illustration of Aristotle's meaning, from a very acute and learned commentator:—" It (motion) is something more than dead capacity; something less than perfect actuality; capacity roused, and striving to quit its latent character; not the capable brass, nor yet the actual statue, but the capacity in energy; that is to say, the brass in fusion while it is becoming the statue and is not yet become."—" The bow moves not because it may be bent, nor because it is bent; but the motion lies between; lies in an imperfect and obscure union of the two together; is the actuality (if I may so say) even of capacity itself: imperfect and obscure, because such is capacity to which it belongs."—Harris, Philosophical Arrangements.

‡ Lib. iv. c. 1.

§ Lib. iv. c. 11.

* De Cœlo, lib. i. c. 2.

† Phys. lib. viii. c. 8.

‡ De Cœlo, lib. i. c. 6.

§ Phys. lib. vii. c. 2.

‖ Mechanica.

¶ Εαν δε εν μηδενι λογῳ φερηται δυο φορȣς

He seemed on the point of discovering some of the real laws of motion, when he was led to ask—"Why are bodies in motion more easily moved than those which are at rest?—And why does the motion cease of things cast into the air? Is it that the force has ceased which sent them forth, or is there a struggle against the motion, or is it through the disposition to fall, does it become stronger than the projectile force, or is it foolish to entertain doubts on this question, when the body has quitted the principle of its motion?" A commentator at the close of the sixteenth century says on this passage: "They fall because every thing recurs to its nature; for if you throw a stone a thousand times into the air, it will never accustom itself to move upwards." Perhaps we shall now find it difficult not to smile at the idea we may form of this luckless experimentalist, teaching stones to fly; yet it may be useful to remember that it is only because we have already collected an opinion from the results of a vast number of observations in the daily experience of life, that our ridicule would not be altogether misplaced, and that we are totally unable to determine by any kind of reasoning, unaccompanied by experiment, whether a stone thrown into the air would fall again to the earth, or move for ever upwards, or in any other conceivable manner and direction.

The opinion which Aristotle held, that motion must be caused by something in contact with the body moved, led him to his famous theory that falling bodies are accelerated by the air through which they pass. We will show how it was attempted to explain this process when we come to speak of more modern authors. He classed natural bodies into heavy and light, remarking at the same time that it is clear that "there are some bodies possessing neither gravity nor levity*." By light bodies he understood those which have a natural tendency to move from the earth, observing that "that which is lighter is not always light†." He maintained that the heavenly bodies were altogether devoid of gravity; and we have already had occasion to mention his assertion, that a large body falls faster than a small one in proportion to its weight*. With this opinion may be classed another great mistake, in maintaining that the same bodies fall through different mediums, as air or water, with velocities reciprocally proportional to their densities. By a singular inversion of experimental science, Cardan, relying on this assertion, proposed in the sixteenth century to determine the densities of air and water by observing the different times taken by a stone in falling through them†. Galileo inquired afterwards why the experiment should not be made with a cork, which pertinent question put an end to the theory.

There are curious traces still preserved in the poem of Lucretius of a mechanical philosophy, of which the credit is in general given to Democritus, where many principles are inculcated strongly at variance with Aristotle's notions. We find absolute levity denied, and not only the assertion that in a vacuum all things would fall, but that they would fall with the same velocity; and the inequalities which we observe are attributed to the right cause, the impediment of the air, although the error remains of believing the velocity of bodies falling through the air to be proportional to their weight‡. Such specimens of this earlier philosophy

κατα μηδενα χρονον, αδυνατον ευθειαν ειναι την φοραν. Εαν γαρ τινα λογον ενεχθῃ εν χρονῳ τινι τουτον αναγκη τον χρονον ευθειαν ειναι φοραν δια τα προειρημενα, ὥστε περιφερες γινεται δυο φερομενον φορας εν μηδενι λογῳ μηδενα χρονον.—*i. e.*
$v = \frac{ds}{dt}$

* De Cœlo, lib. i. c. 3. † Lib. iv. c. 2

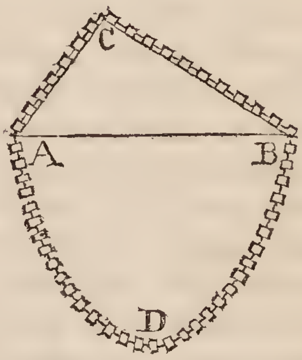
* Phys., lib. iv. c. 8. † De Proport. Basileæ, 1570.

‡ "Nunc locus est, ut opinor, in his illud quoque rebus
Confirmare tibi, nullam rem posse suâ vi
Corpoream sursum ferri, sursumque meare.—
Nec quom subsiliunt ignes ad tecta domorum,
Et celeri flammâ degustant tigna trabeisque
Sponte suâ facere id sine vi subicente putandum est.
—Nonne vides etiam quantâ vi tigna trabeisque
Respuat humor aquæ? Nam quod magi' mersimus altum
Directâ et magnâ vi multi pressimus ægre:—
Tam cupide sursum revomit magis atque remittit
Plus ut parte foras emergant, exsiliantque:
—Nec tamen hæc, quantu'st in sedubitamus, opinor,
Quinvacuum per inane deorsum cuncta ferantur,
Sic igitur debent flammæ quoque posse per auras
Aeris expressæ sursum subsidere, quamquam
Pondera quantum in se est deorsum deducere pugnent.
—Quod si forte aliquis credit Graviora potesse
Corpora, quo citius rectum per Inane feruntur,
—Avius a verâ longe ratione recedit.
Nam per Aquas quæcunque cadunt atque Aera deorsum
Hæc pro ponderibus casus celerare necesse 'st
Propterea quia corpus Aquæ, naturaque tenuis
Aeris haud possunt æque rem quamque morari:
Sed citius cedunt Gravioribus exsuperata.
At contra nulli de nullâ parte, neque ullo
Tempore Inane potest Vacuum subsistere reii
Quin, sua quod natura petit, considere pergat:
Omnia quâ propter debent per Inane quietum
Æque ponderibus non æquis concita ferri."
De Rerum Natura, lib. ii, v. 184—239.

may well indispose us towards Aristotle, who was as successful in the science of motion as he was in astronomy in suppressing the knowledge of a theory so much sounder than that which he imposed so long upon the credulity of his blinded admirers.

An agreeable contrast to Aristotle's mystical sayings and fruitless syllogisms is presented in Archimedes' book on Equilibrium, in which he demonstrates very satisfactorily, though with greater cumbrousness of apparatus than is now thought necessary, the principal properties of the lever. This and the Treatise on the Equilibrium of Floating Bodies are the only mechanical works which have reached us of this writer, who was by common consent one of the most accomplished mathematicians of antiquity. Ptolemy the astronomer wrote also a Treatise on Mechanics, now lost, which probably contained much that would be interesting in the history of mechanics; for Pappus says, in the Preface to the Eighth Book of his Mathematical Collections: "There is no occasion for me to explain what is meant by a heavy, and what by a light body, and why bodies are carried up and down, and in what sense these very words 'up' and 'down' are to be taken, and by what limits they are bounded; for all this is declared in Ptolemy's Mechanics."* This book of Ptolemy's appears to have been also known by Eutocius, a commentator of Archimedes, who lived about the end of the fifth century of our era; he intimates that the doctrines contained in it are grounded upon Aristotle's; if so, its loss is less to be lamented. Pappus's own book deserves attention for the enumeration which he makes of the mechanical powers, namely, the wheel and axle, the lever, pullies, the wedge and the screw. He gives the credit to Hero and Philo of having shown, in works which have not reached us, that the theory of all these machines is the same. In Pappus we also find the first attempt to discover the force necessary to support a given weight on an inclined plane. This in fact is involved in the theory of the screw; and the same vicious reasoning which Pappus employs on this occasion was probably found in those treatises which he quotes with so much approbation. Numerous as are the faults of his pretended demonstration, it was received undoubtingly for a long period.

The credit of first giving the true theory of equilibrium on the inclined plane is usually ascribed to Stevin, although, as we shall presently show, with very little reason. Stevin supposed a chain to be placed over two inclined planes, and to hang down in the manner represented in the figure. He then urged that the chain would be in equilibrium; for otherwise, it would incessantly continue in motion, if there were any cause why it should begin to move. This being conceded, he remarks further, that the parts A D and BD are also in equilibrium, being exactly similar to each other; and therefore if they are taken away, the remaining parts A C and B C will also be in equilibrium. The weights of these parts are proportional to the lengths AC and BC; and hence Stevin concluded that two



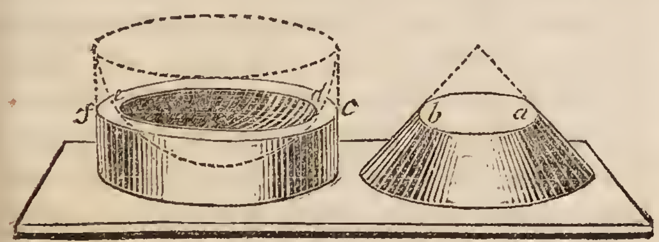

weights would balance on two inclined planes, which are to each other as the lengths of the planes included between the same parallels to the horizon.* This conclusion is the correct one, and there is certainly great ingenuity in this contrivance to facilitate the demonstration; it must not however be mistaken for an *à priori* proof, as it sometimes seems to have been: we should remember that the experiments which led to the principle of virtual velocities are also necessary to show the absurdity of supposing a perpetual motion, which is made the foundation of this theorem. That principle had been applied directly to determine the same proportion in a work written long before, where it has remained singularly concealed from the notice of most who have written on this subject. The book bears the name of Jordanus, who lived at Namur in the thirteenth century; but Commandine, who refers to it in his Commentary on Pappus, considers it as the work of an earlier period. The author takes the principle of virtual velocities for the groundwork of his explanations, both of the lever and inclined plane; the latter will not occupy much space, and in an historical point of view is too curious to be omitted.

* Math. Coll. Pisani, 1662.

* Œuvres Mathématiques. Leyde. 1634.

that it is not repugnant to the nature of things that there should be a vacuum, but merely that it is difficult to produce. To explain myself more clearly: if we allow that the air has weight, there is no difference between air and water except in degree. At the bottom of the sea the weight of the water above me compresses everything round my body, and it strikes me that the same thing must happen in the air, we being placed at the bottom of its immensity; we do not feel its weight, nor the compression round us, because our bodies are made capable of supporting it. But if we were in a vacuum, then the weight of the air above our heads would be felt. It would be felt very great, but not infinite, and therefore determinable, and it might be overcome by a force proportioned to it. In fact I estimate it to be such that, to make a vacuum, I believe we require a force greater than that of a column of water thirty feet high*."

This subject is introduced by some observations on the force of cohesion, Galileo seeming to be of opinion that, although it cannot be adequately accounted for by "the great and principal resistance to a vacuum, yet that perhaps a sufficient cause may be found by considering every body as composed of very minute particles, between every two of which is exerted a similar resistance." This remark serves to lead to a discussion on indivisibles and infinite quantities, of which we shall merely extract what Galileo gives as a curious paradox suggested in the course of it. He supposes a basin to be formed by scooping a hemisphere out of a cylinder, and a cone to be taken of the same depth and base as the hemisphere. It is easy to show, if the cone and scooped cylinder be both supposed to be cut by the same plane, parallel to




the one on which both stand, that the area of the ring C D E F thus discovered in the cylinder is equal to the area of the corresponding circular section AB of the cone, wherever the cutting plane is supposed to be*. He then proceeds with these remarkable words:—"If we raise the plane higher and higher, one of these areas terminates in the circumference of a circle, and the other in a point, for such are the upper rim of the basin and the top of the cone. Now since in the diminution of the two areas they to the very last maintain their equality to one another, it is in my thoughts proper to say that the highest and ultimate terms † of such diminutions are equal, and not one infinitely bigger than the other. It seems therefore that the circumference of a large circle may be said to be equal to one single point. And why may not these be called equal if they be the last remainders and vestiges left by equal magnitudes ‡?"

We think no one can refuse to admit the probability, that Newton may have found in such passages as these the first germ of the idea of his prime and ultimate ratios, which afterwards became in his hands an instrument of such power. As to the paradoxical result, Descartes undoubtedly has given the true answer to it in saying that it only proves that the line is not a greater area than the point is. Whilst on this subject, it may not be uninteresting to remark that something similar to the doctrine of fluxions seems to have been lying dormant in the minds of the mathematicians of Galileo's era, for Inchoffer illustrates his argument in the treatise we have already mentioned, that the Copernicans may deduce some true results from what he terms their absurd hypothesis, by observing, that mathematicians may deduce the truth that a line is length without breadth, from the false and physically impossible supposition that a point flows, and that a line is the fluxion of a point §.

A suggestion that perhaps fire dissolves bodies by insinuating itself between their minute particles, brings on the subject of the violent effects of heat and light; on which Sagredo inquires, whether we are to take for granted that the effect of light does or does not require time. Simplicio is ready with an answer, that the discharge of artillery proves the transmission of light to be

* Venturi, vol. ii.

* Galileo also reasons in the same way on the equality of the solids standing on the cutting plane, but one is sufficient for our present purpose.

† Gli altissimi e ultimi termini.

‡ Le ultime reliquie e vestigie lasciate da grandezze eguali.

§ Punctum fluere, et lineam esse fluxum puncti. Tract. Syllept. Romæ, 1633.

instantaneous, to which Sagredo cautiously replies, that nothing can be gathered from that experiment except that light travels more swiftly than sound; nor can we draw any decisive conclusion from the rising of the sun. "Who can assure us that he is not in the horizon before his rays reach our sight?" Salviati then mentions an experiment by which he endeavoured to examine this question. Two observers are each to be furnished with a lantern: as soon as the first shades his light, the second is to discover his, and this is to be repeated at a short distance till the observers are perfect in the practice. The same thing is to be tried at the distance of several miles, and if the first observer perceive any delay between shading his own light and the appearance of his companion's, it is to be attributed to the time taken by the light in traversing twice the distance between them. He allows that he could discover no perceptible interval at the distance of a mile, at which he had tried the experiment, but recommends that with the help of a telescope it should be tried at much greater distances. Sir Kenelm Digby remarks on this passage: "It may be objected (if there be some observable tardity in the motion of light) that the sunne would never be truly in that place in which unto our eyes he appeareth to be; because that it being seene by means of the light which issueth from it, if that light required time to move in, the sunne (whose motion is so swifte) would be removed from the place where the light left it, before it could be with us to give tidings of him. To this I answer, allowing peradventure that it may be so, who knoweth the contrary? Or what inconvenience would follow if it be admitted * ?"

The principal thing remaining to be noticed is the application of the theory of the pendulum to musical concords and dissonances, which are explained, in the same manner as by Kepler in his "Harmonices Mundi," to result from the concurrence or opposition of vibrations in the air striking upon the drum of the ear. It is suggested that these vibrations may be made manifest by rubbing the finger round a glass set in a large vessel of water; "and if by pressure the note is suddenly made to rise to the octave above, every one of the undulations which will be seen regularly spreading round the glass, will suddenly split into two, proving that the vibrations that occasion the octave are double those belonging to the simple note.*" Galileo then describes a method he discovered by accident of measuring the length of these waves more accurately than can be done in the agitated water. He was scraping a brass plate with an iron chisel, to take out some spots, and moving the tool rapidly upon the plate, he occasionally heard a hissing and whistling sound, very shrill and audible, and whenever this occurred, and then only, he observed the light dust on the plate to arrange itself in a long row of small parallel streaks equidistant from each other. In repeated experiments he produced different tones by scraping with greater or less velocity, and remarked that the streaks produced by the acute sounds stood closer together than those from the low notes. Among the sounds produced were two, which by comparison with a viol he ascertained to differ by an exact fifth; and measuring the spaces occupied by the streaks in both experiments, he found thirty of the one equal to forty-five of the other, which is exactly the known proportion of the lengths of strings of the same material which sound a fifth to each other *.

Salviati also remarks, that if the material be not the same, as for instance if it be required to sound an octave to a note on catgut, on a wire of the same length, the weight of the wire must be made four times as great, and so for other intervals. "The immediate cause of the forms of musical intervals is neither the length, the tension, nor the thickness, but the proportion of the numbers of the undulations of the air which strike upon the drum of the ear, and make it vibrate in the same intervals. Hence we may gather a plausible reason of the different sensations occasioned to us by different couples of sounds, of which we hear some with great pleasure, some with less, and call them accordingly concords, more or less perfect, whilst some excite in us great dissatisfaction, and are called discords. The disagreeable sensation belonging to the latter

* "Treatise of the Nature of Bodies. London, 1665."

* This beautiful experiment is more easily tried by drawing the bow of a violin across the edge of glass strewed with fine dry sand. Those who wish to see more on the subject may consult Chladni's 'Acoustique.'

probably arises from the disorderly manner in which the vibrations strike the drum of the ear; so that for instance a most cruel discord would be produced by sounding together two strings, of which the lengths are to each other as the side and diagonal of a square, which is the discord of the false fifth. On the contrary, agreeable consonances will result from those strings of which the numbers of vibrations made in the same time are commensurable, "to the end that the cartilage of the drum may not undergo the incessant torture of a double inflexion from the disagreeing percussions." Something similar may be exhibited to the eye by hanging up pendulums of different lengths: "if these be proportioned so that the times of their vibrations correspond with those of the musical concords, the eye will observe with pleasure their crossings and interweavings still recurring at appreciable intervals; but if the times of vibration be incommensurate, the eye will be wearied and worn out with following them."

The second dialogue is occupied entirely with an investigation of the strength of beams, a subject which does not appear to have been examined by any one before Galileo beyond Aristotle's remark, that long beams are weaker, because they are at once the weight, the lever, and the fulcrum; and it is in the development of this observation that the whole theory consists. The principle assumed by Galileo as the basis of his inquiries is, that the force of cohesion with which a beam resists a cross fracture in any section may all be considered as acting at the centre of gravity of the section, and that it breaks always at the lowest point: from this he deduced that the effect of the weight of a prismatic beam in overcoming the resistance of one end by which it is fastened to a wall, varies directly as the square of the length, and inversely as the side of the base. From this it immediately follows, that if for instance the bone of a large animal be three times as long as the corresponding one in a smaller beast, it must be nine times as thick to have the same strength, provided we suppose in both cases that the materials are of the same consistence. An elegant result which Galileo also deduced from this theory, is that the form of such a beam, to be equally strong in every part, should be that of a parabolical prism, the vertex of the parabola being the farthest removed from the wall. As an easy mode of describing the parabolic curve for this purpose, he recommends tracing the line in which a heavy flexible string hangs. This curve is not an accurate parabola: it is now called a catenary; but it is plain from the description of it in the fourth dialogue, that Galileo was perfectly aware that this construction is only approximately true. In the same place he makes the remark, which to many is so paradoxical, that no force, however great, exerted in a horizontal direction, can stretch a heavy thread, however slender, into an accurately straight line.

The fifth and sixth dialogues were left unfinished, and annexed to the former ones by Viviani after Galileo's death: the fragment of the fifth, which is on the subject of Euclid's Definition of Ratio, was at first intended to have formed a part of the third, and followed the first proposition on equable motion: the sixth was intended to have embodied Galileo's researches on the nature and laws of Percussion, on which he was employed at the time of his death. Considering these solely as fragments, we shall not here make any extracts from them.

## Chapter XVIII.

*Correspondence on Longitudes.—Pendulum Clock.*

In the spring of 1636, having finished his Dialogues on Motion, Galileo resumed the plan of determining the longitude by means of Jupiter's satellites. Perhaps he suspected something of the private intrigue which thwarted his former expectations from the Spanish government, and this may have induced him on the present occasion to negotiate the matter without applying for Ferdinand's assistance and recommendation. Accordingly he addressed himself to Lorenz Real, who had been Governor General of the Dutch possessions in India, freely and unconditionally offering the use of his theory to the States General of Holland. Not long before, his opinion had been requested by the commissioners appointed at Paris to examine and report on the practicability of another method proposed by Morin,* which consisted in observing the distance of the moon from a known star. Morin was a French philosopher, prin-

* One of the Commissioners was the father of Blaise Pascal.

cipally known as an astrologer and zealous Anti-Copernican; but his name deserves to be recorded as undoubtedly one of the first to recommend a method, which, under the name of a Lunar distance, is now in universal practice.

The monthly motion of the moon is so rapid, that her distance from a given star sensibly varies in a few minutes even to the unassisted eye; and with the aid of the telescope, we can of course appreciate the change more accurately. Morin proposed that the distances of the moon from a number of fixed stars lying near her path in the heavens should be beforehand calculated and registered for every day in the year, at a certain hour, in the place from which the longitudes were to be reckoned, as for instance at Paris. Just as in the case of the eclipses of Jupiter's satellites, the observer, when he saw that the moon had arrived at the registered distance, would know the hour at Paris: he might also make allowance for intermediate distances. Observing at the same instant the hour on board his ship, the difference between the two would show his position in regard of longitude. In using this method as it is now practised, several modifications are to be attended to, without which it would be wholly useless, in consequence of the refraction of the atmosphere, and the proximity of the moon to the earth. Owing to the latter cause, if two spectators should at the same instant of time, but in different places, measure the distance of the moon in the East, from a star still more to the eastward, it would appear greater to the more easterly spectator than to the other observer, who as seen from the star would be standing more directly behind the moon. The mode of allowing for these alterations is taught by trigonometry and astronomy.

The success of this method depends altogether upon the exact knowledge which we now have of the moon's course, and till that knowledge was perfected it would have been found altogether illusory. Such in fact was the judgment which Galileo pronounced upon it. "As to Morin's book on the method of finding the longitude by means of the moon's motion, I say freely that I conceive this idea to be as accurate in theory, as fallacious and impossible in practice. I am sure that neither you nor any one of the other four gentlemen can doubt the possibility of finding the difference of longitude between two meridians by means of the moon's motion, provided we are sure of the following requisites: First, an Ephemeris of the moon's motion exactly calculated for the first meridian from which the others are to be reckoned; secondly, exact instruments, and convenient to handle, in taking the distance between the moon and a fixed star; thirdly, great practical skill in the observer; fourthly, not less accuracy in the scientific calculations, and astronomical computations; fifthly, very perfect clocks to number the hours, or other means of knowing them exactly, &c. Supposing, I say, all these elements free from error, the longitude will be accurately found; but I reckon it more easy and likely to err in all of these together, than to be practically right in one alone. Morin ought to require his judges to assign, at their pleasure, eight or ten moments of different nights during four or six months to come, and pledge himself to predict and assign by his calculations the distances of the moon at those determined instants from some star which would then be near her. If it is found that the distances assigned by him agree with those which the quadrant or sextant* will actually show, the judges would be satisfied of his success, or rather of the truth of the matter, and nothing would remain but to show that his operations were such as could be performed by men of moderate skill, and also practicable at sea as well as on land. I incline much to think that an experiment of this kind would do much towards abating the opinion and conceit which Morin has of himself, which appears to me so lofty, that I should consider myself the eighth sage, if I knew the half of what Morin presumes to know."

It is probable that Galileo was biassed by a predilection for his own method, on which he had expended so much time and labour; but the objections which he raises against Morin's proposal in the foregoing letter are no other than those to which at that period it was undoubtedly open. With regard to his own, he had already, in 1612, given a rough prediction of the course of Jupiter's satellites, which had been found to agree tolerably well with subsequent observations; and since that

* These instruments were very inferior to those now in use under the same name. See "Treatise on Opt. Instrum."

time, amid all his other employments, he had almost unintermittingly during twenty-four years continued his observations, for the sake of bringing the tables of their motions to as high a state of perfection as possible. This was the point to which the inquiries of the States in their answer to Galileo's frank proposal were principally directed. They immediately appointed commissioners to communicate with him, and report the various points on which they required information. They also sent him a golden chain, and assured him that in the case of the design proving successful, he should have no cause to complain of their want of gratitude and generosity. The commissioners immediately commenced an active correspondence with him, in the course of which he entered into more minute details with regard to the methods by which he proposed to obviate the practical difficulties of the necessary observations.

It is worth noticing that the secretary to the Prince of Orange, who was mainly instrumental in forming this commission, was Constantine Huyghens, father of the celebrated mathematician of that name, of whom it has been said that he seemed destined to complete the discoveries of Galileo; and it is not a little remarkable, that Huyghens nowhere in his published works makes any allusion to this connexion between his father and Galileo, not even during the discussion that arose some years later on the subject of the pendulum clock, which must necessarily have forced it upon his recollection.

The Dutch commissioners had chosen one of their number to go into Italy for the purpose of communicating personally with Galileo, but he discouraged this scheme, from a fear of its giving umbrage at Rome. The correspondence being carried on at so great a distance necessarily experienced many tedious delays, till in the very midst of Galileo's labours to complete his tables, he was seized with the blindness which we have already mentioned. He then resolved to place all the papers containing his observations and calculations for this purpose in the hands of Renieri, a former pupil of his, and then professor of mathematics at Pisa, who undertook to finish and to forward them into Holland. Before this was done, a new delay was occasioned by the deaths which speedily followed each other of every one of the four commissioners; and for two or three years the correspondence with Holland was entirely interrupted. Constantine Huyghens, who was capable of appreciating the value of the scheme, succeeded after some trouble in renewing it, but only just before the death of Galileo himself, by which of course it was a second time broken off; and to complete the singular series of obstacles by which the trial of this method was impeded, just as Renieri, by order of the Duke of Tuscany, was about to publish the ephemeris and tables which Galileo had entrusted to him, and which the Duke told Viviani he had seen in his possession, he also was attacked with a mortal malady; and upon his death the manuscripts were nowhere to be found, nor has it since been discovered what became of them. Montucla has intimated his suspicions that Renieri himself destroyed them, from a consciousness that they were insufficient for the purpose to which it was intended to apply them; a bold conjecture, and one which ought to rest upon something more than mere surmise: for although it may be considered certain, that the practical value of these tables would be very inconsiderable in the present advanced state of knowledge, yet it is nearly as sure that they were unique at that time, and Renieri was aware of the value which Galileo himself had set upon them, and should not be lightly accused of betraying his trust in so gross a manner. In 1665, Borelli calculated the places of the satellites for every day in the ensuing year, which he professed to have deduced (by desire of the Grand Duke) from Galileo's tables;* but he does not say whether or not these tables were the same that had been in Renieri's possession.

We have delayed till this opportunity to examine how far the invention of the pendulum clock belongs to Galileo. It has been asserted that the isochronism of the pendulum had been noticed by Leonardo da Vinci, but the passage on which this assertion is founded (as translated from his manuscripts by Venturi) scarcely warrants this conclusion. "A rod which engages itself in the opposite teeth of a spur-wheel can act like the arm of the balance in clocks, that is to say, it will act alternately, first on one side of the wheel, then on the opposite

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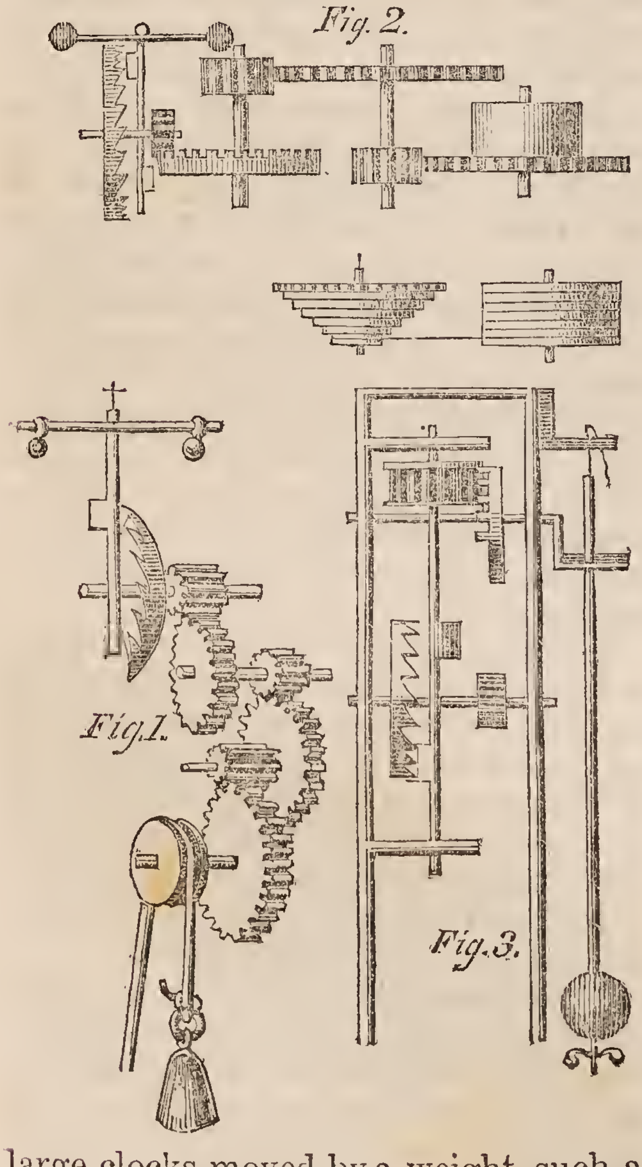
* Theoricæ Mediceorum Planetarum, Florentiæ, 1666.

one, without interruption." If Da Vinci had constructed a clock on this principle, and recognized the superiority of the pendulum over the old balance, he would surely have done more than merely mention it as affording an unintermitted motion "like the arm of the balance." The use of the balance is supposed to have been introduced at least as early as the fourteenth century. Venturi mentions the drawing and description of a clock in one of the manuscripts of the King's Library at Paris, dated about the middle of the fifteenth century, which as he says nearly resembles a modern watch. The balance is there called "The circle fastened to the stem of the pallets, and moved by the force with it.* In that singularly wild and extravagant book, entitled "A History of both Worlds," by Robert Flud, are given two drawings of the wheel-work of the clocks and watches in use before the application of the pendulum. An inspection of them will show how little remained to be done when the isochronism of the pendulum was discovered. *Fig.* 1. represents "the




large clocks moved by a weight, such as are put up in churches and turrets; *fig.* 2. the small ones moved by a spring, such as are worn round the neck, or placed on a shelf or table. The use of the chain is to equalize the spring, which is strongest at the beginning of its motion."* This contrivance of the chain is mentioned by Cardan, in 1570, and is probably still older. In both figures the name given to the cross bar, with the weight attached to it, is "the time or balance (*tempus seu libratio*) by which the motion is equalized." The manner in which Huyghens first applied the pendulum is shown in *fig.* 3.† The action in the old clocks of the balance, or *rake*, as it was also called, was by checking the motion of the descending weight till its inertia was overcome; it was then forced round till the opposite pallet engaged in the toothed wheel. The balance was thus suddenly and forcibly reduced to a state of rest, and again set in motion in the opposite direction. It will be observed that these balances wanted the spiral spring introduced in all modern watches, which has a property of isochronism similar to that of the pendulum. Hooke is generally named as the discoverer of this property of springs, and as the author of its application to the improvement of watches, but the invention is disputed with him by Huyghens. Lahire asserts‡ that the isochronism of springs was communicated to Huyghens at Paris by Hautefeuille, and that this was the reason why Huyghens failed to obtain the patent he solicited for the construction of spring watches. A great number of curious contrivances at this early period in the history of Horology, may be seen in Schott's Magia Naturæ, published at Nuremberg in 1664.

Galileo was early convinced of the importance of his pendulum to the accuracy of astronomical observations; but the progress of invention is such that the steps which on looking back seem the easiest to make, are often those which are the longest delayed. Galileo recognized the principle of the isochronism of the pendulum, and recommended it as a measurer of time in 1583; yet fifty years later, although constantly using it, he had not devised a more convenient method of doing so, than is contained in the following description taken from his "Astronomical Operations."

* Circulus affixus virgæ paletorum qui cum eâ de vi movetur.

* Utriusque Cosmi Historia. Oppenhemii, 1617.
† Huygenii Opera. Lugduni, 1724.
‡ Mémoires de l'Academie, 1717.

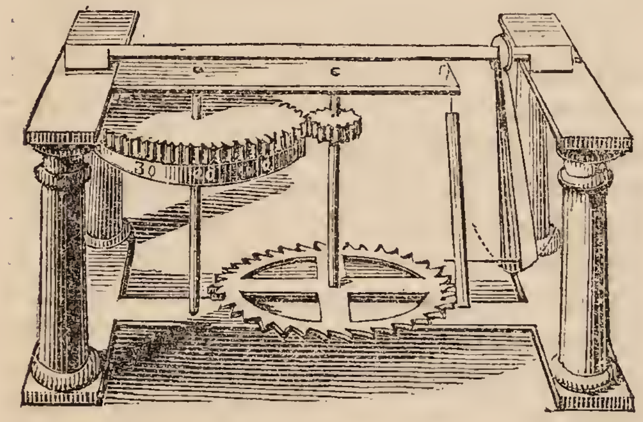
"A very exact time-measurer for minute intervals of time, is a heavy pendulum of any size hanged by a fine thread, which, if removed from the perpendicular and allowed to swing freely, always completes its vibrations, be they great or small, in exactly the same time."*

The mode of finding exactly by means of this the quantity of any time reduced to hours, minutes, seconds, &c., which are the divisions commonly used among astronomers, is this:—"Fit up a pendulum of any length, as for instance about a foot long, and count patiently (only for once) the number of vibrations during a natural day. Our object will be attained if we know the exact revolution of the natural day. The observer must then fix a telescope in the direction of any star, and continue to watch it till it disappears from the field of view. At that instant he must begin to count the vibrations of the pendulum, continuing all night and the following day till the return of the same star within the field of view of the telescope, and its second disappearance, as on the first night. Bearing in recollection the total number of vibrations thus made in twenty-four hours, the time corresponding to any other number of vibrations will be immediately given by the Golden Rule."

A second extract out of Galileo's Dutch correspondence, in 1637, will show the extent of his improvements at that time:—"I come now to the second contrivance for increasing immensely the exactness of astronomical observations. I allude to my time-measurer, the precision of which is so great, and such, that it will give the exact quantity of hours, minutes, seconds, and even thirds, if their recurrence could be counted; and its constancy is such that two, four, or six such instruments will go on together so equably that one will not differ from another so much as the beat of a pulse, not only in an hour, but even in a day or a month."—"I do not make use of a weight hanging by a thread, but a heavy and solid pendulum, made for instance of brass or copper, in the shape of a circular sector of twelve or fifteen degrees, the radius of which may be two or three palms, and the greater it is the less trouble will there be in attending it. This sector, such as I have described, I make thickest in the middle radius, tapering gradually towards the edges, where I terminate it in a tolerably sharp line, to obviate as much as possible the resistance of the air, which is the sole cause of its retardation."—[These last words deserve notice, because, in a previous discussion, Galileo had observed that the parts of the pendulum nearest the point of suspension have a tendency to vibrate quicker than those at the other end, and seems to have thought erroneously that the stoppage of the pendulum is partly to be attributed to this cause.]—"This is pierced in the centre, through which is passed an iron bar shaped like those on which steelyards hang, terminated below in an angle, and placed on two bronze supports, that they may wear away less during a long motion of the sector. If the sector (when accurately balanced) be removed several degrees from its perpendicular position, it will continue a reciprocal motion through a very great number of vibrations before it will stop; and in order that it may continue its motion as long as is wanted, the attendant must occasionally give it a smart push, to carry it back to large vibrations." Galileo then describes as before the method of counting the vibrations in the course of a day, and gives the rule that the lengths of two similar pendulums will have the same proportion as the squares of their times of vibration. He then continues: "Now to save the fatigue of the assistant in continually counting the vibrations, this is a convenient contrivance: A very small and delicate needle extends out from the middle of the circumference of the sector, which in passing strikes a rod fixed at one end; this rod rests upon the teeth of a wheel as light as paper, placed in a horizontal plane near the pendulum, having round it teeth cut like those of a saw, that is to say, with one side of each tooth perpendicular to the rim of the wheel and the other inclined obliquely. The rod striking against the perpendicular side of the tooth moves it, but as the same rod returns against the oblique side, it does not move it the contrary way, but slips over it and falls at the foot of the following tooth, so that the motion of the wheel will be always in the same direction. And by counting the teeth you may see at will the number of teeth passed, and consequently the number of vibrations and of particles of time elapsed. You may also fit to the axis

* See page 84.

of this first wheel a second, with a small number of teeth, touching another greater toothed wheel, &c. But it is superfluous to point out this to you, who have by you men very ingenious and well skilled in making clocks and other admirable machines; and on this new principle, that the pendulum makes its great and small vibrations in the same time exactly, they will invent contrivances more subtle than any I can suggest; and as the error of clocks consists principally in the disability of workmen hitherto to adjust what we call the balance of the clock, so that it may vibrate regularly, my very simple pendulum, which is not liable to any alteration, affords a mean of maintaining the measures of time always equal." The contrivance thus described would be somewhat similar to the annexed representation, but it is almost certain that no such instrument was actually constructed.



It must be owned that Galileo greatly overrated the accuracy of his timekeeper; and in asserting so positively that which he had certainly not experienced, he seems to depart from his own principles of philosophizing. It will be remarked that in this passage he still is of the erroneous opinion, that all the vibrations great or small of the same pendulum take exactly the same time; and we have not been able to find any trace of his having ever held a different opinion, unless perhaps in the Dialogues, where he says, "If the vibrations are not exactly equal, they are at least insensibly different." This is very much at variance with the statement in the Memoirs of the Academia del Cimento, edited by their secretary Magalotti, on the credit of which Galileo's claim to the pendulum-clock chiefly rests. It is there said that experience shows that the smallest vibrations are rather the quickest, "as Galileo announced after the observation, which in 1583 he was the first to make of their approximate equality." It is not possible immediately in connexion with so glaring a misstatement, to give implicit credence to the assertion in the next sentence, that "*to obviate this inconvenience*" Galileo was the first to contrive a clock, constructed in 1649, by his son Vincenzo, in which, by the action of a weight or spring, the pendulum was constrained to move always from the same height. Indeed it appears as if Magalotti did not always tell this story in the same manner, for he is referred to as the author of the account given by Becher, "that Galileo himself made a pendulum-clock one of which was sent to Holland," plainly insinuating that Huyghens was a mere copyist.* These two accounts therefore serve to invalidate each other's credibility. Tiraboschi† asserts that, at the time he wrote, the mathematical professor at Pisa was in possession of the identical clock constructed by Treffler under Vincenzo's directions; and quotes a letter from Campani, to whom it was shown by Ferdinand, "old, rusty, and unfinished as Galileo's son made it before 1649." Viviani on the other hand says that Treffler constructed this same clock some time after Vincenzo's death (which happened in 1649), on a different principle from Vincenzo's ideas, although he says distinctly that he heard Galileo describe an application of the pendulum to a clock similar to Huyghens' contrivance. Campani did not actually see this clock till 1659, which was three years after Huyghens' invention, so that perhaps Huyghens was too easily satisfied when, on occasion of the answer which Ferdinand sent to his complaints of the Memorie del Cimento he wrote to Bouillaud, "I must however believe, since such a prince assures me, that Galileo had this idea before me."

There is another circumstance almost amounting to a proof that it was an afterthought to attribute the merit of constructing the pendulum-clock to Galileo, for on the reverse of a medal struck by Viviani, and inscribed "to the memory of his excellent instructor,"‡ is a rude exhibition of the principal objects to which Galileo's attention was directed. The pendulum is represented simply by a weight attached to a string hanging on the face of a rock. It is probable that,

* De nova Temporis dimetiendi ratione. Londini, 1630.
† Storia della Lett. Ital.
‡ Museum Mazuchellianum, vol. ii. Tab. cvii. p. 29.

in a design expressly intended to commemorate Galileo's inventions, Viviani would have introduced the timekeeper in the most perfect form to which it had been brought by him. Riccioli,* whose industry was unwearied in collecting every fact and argument which related in any way to the astronomical and mechanical knowledge and opinions of his time, expressly recommends swinging a pendulum, or perpendicular as it was often called (only a few years before Huyghens' publication), as much more accurate *than any clock*.† Join to all these arguments Huyghens' positive assertion, that if Galileo had conceived any such idea, he at least was entirely ignorant of it,‡ and no doubt can remain that the merit of the original invention (such as it was) rests entirely with Huyghens. The step indeed seems simple enough for a less genius than his: for the property of the pendulum was known, and the conversion of a rotatory into a reciprocating motion was known; but the connexion of the one with the other having been so long delayed, we must suppose that difficulties existed where we are not now able to perceive them, for Huyghens' improvement was received with universal admiration.

There may be many who will consider the pendulum as undeserving so long a discussion; who do not know or remember that the telescope itself has hardly done more for the precision of astronomical observations than this simple instrument, not to mention the invaluable convenience of an uniform and accurate timekeeper in the daily intercourse of life. The patience and industry of modern observers are often the theme of well-merited praise, but we must look with a still higher degree of wonder on such men as Tycho-Brahe and his contemporaries, who were driven by the want of any timekeeper on which they could depend to the most laborious expedients, and who nevertheless persevered to the best of their ability, undisgusted either by the tedium of such processes, or by the discouraging consciousness of the necessary imperfection of their most approved methods and instruments.

The invariable regularity of the pendulum's motion was soon made subservient to ulterior purposes beyond that of merely registering time. We have seen the important assistance it afforded in establishing the laws of motion; and when the theory founded on those laws was extended and improved, the pendulum was again instrumental, by a species of approximate reasoning familiar to all who are acquainted with physical inquiries, in pointing out by its minute irregularities in different parts of the earth, a corresponding change in the weight of all bodies in those different situations, supposed to be the consequence of a greater distance from the axis of the earth's rotation; since that would occasion the force of attraction to be counterbalanced by an increased centrifugal force. The theory which kept pace with the constantly increasing accuracy of such observations, proving consistent in all trials of it, has left little room for future doubts; and in this manner the pendulum in intelligent hands became the simplest instrument for ascertaining the form of the globe which we inhabit. An English astronomer, who corresponded with Kepler under the signature of Brutius (whose real name perhaps might be Bruce), had already declared his belief in 1603, that "the earth on which we tread is neither round nor globular, but more nearly of an oval figure."* There is nothing to guide us to the grounds on which he formed this opinion, which was perhaps only a lucky guess. Kepler's note upon it is: "This is not altogether to be contemned."

A farther use of the pendulum is in furnishing a general and unperishing standard of measure. This application is suggested in the third volume of the 'Reflections' of Mersenne, published in 1647, where he observes that it may be best for the future not to divide time into hours, minutes, and seconds, but to express its parts by the number of vibrations of a pendulum of given length, swinging through a given arc. It was soon seen that it would be more convenient to invert this process, and to choose as an unit of length the pendulum which should make a certain number of vibrations in the unit of time, naturally determined by the revolution of the earth on its axis. Our Royal Society took an active part in these experiments, which seem, notwithstanding their utility, to have met from the first with much of the same ridicule which was lavished

* Almagestum Novum, vol. i.
† Quovis horologio accuratius.
‡ Clarorum Belgarum ad Ant. Magliabech. Epistolæ. Florence, 1745, tom. i. p. 235.

* Kepleri Epistolæ.

upon them by the ignorant, when recently repeated for the same purpose. "I contend," says Graunt* in a dedication to the Royal Society, dated 1662, "against the envious schismatics of your society (who think you do nothing unless you presently transmute metals, make butter and cheese without milk, and, as their own ballad hath it, make leather without hides), by asserting the usefulness of even all your preparatory and luciferous experiments, being not the ceremonies, but the substance and principles of useful arts. For I find in trade the want of an universal measure, and have heard musicians wrangle about the just and uniform keeping of time in their consorts, and therefore cannot with patience hear that your labours about vibrations, eminently conducing to both, should be slighted, nor your pendula called swing-swangs with scorn."†

## Chapter XIX.

*Character of Galileo—Miscellaneous details—his Death—Conclusion.*

The remaining years of Galileo's life were spent at Arcetri, where indeed, even if the Inquisition had granted his liberty, his increasing age and infirmities would probably have detained him. The rigid caution with which he had been watched in Florence was in great measure relaxed, and he was permitted to see the friends who crowded round him to express their respect and sympathy. The Grand Duke visited him frequently, and many distinguished strangers, such as Gassendi and Deodati, came into Italy solely for the purpose of testifying their admiration of his character. Among other visitors the name of Milton will be read with interest: we may probably refer to the effects of this interview the allusions to Galileo's discoveries, so frequently introduced into his poem. Milton mentions in his 'Areopagitica,' that he saw Galileo whilst in Italy, but enters into no details of his visit.

* Natural and Political Observations. London, 1665.

† See also Hudibras, Part II. Cant. III.

> They're guilty by their own confessions
> Of felony, and at the Sessions
> Upon the bench I will so handle 'em,
> That the vibration of this pendulum
> Shall make all taylors' yards of one
> Unanimous opinion;
> A thing he long has vaunted of,
> But now shall make it out of proof.

Hudibras was certainly written before 1663: ten years later Huyghens speaks of the idea of so employing the pendulum as a common one.

Galileo was fond of society, and his cheerful and popular manners rendered him an universal favourite among those who were admitted to his intimacy. Among these, Viviani, who formed one of his family during the three last years of his life, deserves particular notice, on account of the strong attachment and almost filial veneration with which he ever regarded his master and benefactor. His long life, which was prolonged to the completion of his 81st year in 1703, enabled him to see the triumphant establishment of the truths on account of which Galileo had endured so many insults; and even in his old age, when in his turn he had acquired a claim to the reverence of a younger generation, our Royal Society, who invited him among them in 1696, felt that the complimentary language in which they addressed him as the first mathematician of the age would have been incomplete and unsatisfactory without an allusion to the friendship that gained him the cherished title of "The last pupil of Galileo."*

Torricelli, another of Galileo's most celebrated followers, became a member of his family in October, 1641: he first learned mathematics from Castelli, and occasionally lectured for him at Rome, in which manner he was employed when Galileo, who had seen his book 'On Motion,' and augured the greatest success from such a beginning, invited him to his house—an offer which Torricelli eagerly embraced, although he enjoyed the advantages of it but for a short time. He afterwards succeeded Galileo in his situation at the court of Florence,† but survived him only a few years.

It is from the accounts of Viviani and Gherardini that we principally draw the following particulars of Galileo's person and character:—Signor Galileo was of a cheerful and pleasant countenance, especially in his old age, square built, and well proportioned in stature, and rather above the middle size. His complexion was fair and sanguine, his eyes brilliant, and his hair of a reddish cast. His constitution was naturally

* The words of his diploma are: Galilæi in mathematicis disciplinis discipulus, in ærumnis socius, Italicum ingenium ita perpolivit optimis artibus ut inter mathematicos sæculi nostri facile princeps per orbem litterarium numeretur.—Tiraboschi.

† On this occasion the taste of the time showed itself in the following anagram:—

> Evangelista Torricellieus,
> En virescit Galilæus alter.

strong, but worn out by fatigue of mind and body, so as frequently to be reduced to a state of the utmost weakness. He was subject to attacks of hypochondria, and often molested by severe and dangerous illnesses, occasioned in great measure by his sleepless nights, the whole of which he frequently spent in astronomical observations. During upwards of forty-eight years of his life, he was tormented with acute rheumatic pains, suffering particularly on any change of weather. He found himself most free from these pains whilst residing in the country, of which consequently he became very fond: besides, he used to say that in the country he had greater freedom to read the book of Nature, which lay there open before him. His library was very small, but well chosen, and open to the use of the friends whom he loved to see assembled round him, and whom he was accustomed to receive in the most hospitable manner. He ate sparingly himself; but was particularly choice in the selection of his wines, which in the latter part of his life were regularly supplied out of the Grand Duke's cellars. This taste gave an additional stimulus to his agricultural pursuits, and many of his leisure hours were spent in the cultivation and superintendence of his vineyards. It should seem that he was considered a good judge of wine; for Viviani has preserved one of his receipts in a collection of miscellaneous experiments. In it he strongly recommends that for wine of the first quality, that juice only should be employed, which is pressed out by the mere weight of the heaped grapes, which would probably be that of the ripest fruit. The following letter, written in his 74th year, is dated, "From my prison at Arcetri.—I am forced to avail myself of your assistance and favour, agreeably to your obliging offers, in consequence of the excessive chill of the weather, and of old age, and from having drained out my grand stock of a hundred bottles, which I laid in two years ago; not to mention some minor particulars during the last two months, which I received from my Serene Master, the Most Eminent Lord Cardinal, their Highnesses the Princes, and the Most Excellent Duke of Guise, besides cleaning out two barrels of the wine of this country. Now, I beg that with all due diligence and industry, and with consideration, and taking counsel with the most refined palates, you will provide me with two cases, that is to say, with forty flasks of different wines, the most exquisite that you can find: take no thought of the expense, because I stint myself so much in all other pleasures that I can afford to lay out something at the request of Bacchus, without giving offence to his two companions Ceres and Venus. You must be careful to leave out neither Scillo nor Carino (I believe they meant to call them Scylla and Charybdis), nor the country of my master, Archimedes of Syracuse, nor Greek wines, nor clarets, &c. &c. The expense I shall easily be able to satisfy, but not the infinite obligation."

In his expenditure Galileo observed a just mean between avarice and profusion: he spared no cost necessary for the success of his many and various experiments, and spent large sums in charity and hospitality, and in assisting those in whom he discovered excellence in any art or profession, many of whom he maintained in his own house. His temper was easily ruffled, but still more easily pacified. He seldom conversed on mathematical or philosophical topics except among his intimate friends; and when such subjects were abruptly brought before him, as was often the case by the numberless visitors he was in the habit of receiving, he showed great readiness in turning the conversation into more popular channels, in such manner however that he often contrived to introduce something to satisfy the curiosity of the inquirers. His memory was uncommonly tenacious, and stored with a vast variety of old songs and stories, which he was in the constant habit of quoting and alluding to. His favourite Italian authors were Ariosto, Petrarca, and Berni, great part of whose poems he was able to repeat. His excessive admiration of Ariosto determined the side which he took against Tasso in the virulent and unnecessary controversy which has divided Italy so long on the respective merits of these two great poets; and he was accustomed to say that reading Tasso after Ariosto was like tasting cucumbers after melons. When quite a youth, he wrote a great number of critical remarks on Tasso's Gerusalemme Liberata, which one of his friends borrowed, and forgot to return. For a long time it was thought that the manuscript had perished, till the Abbé Serassi discovered it, whilst collecting materials for his Life of Tasso, pub-

lished at Rome in 1785. Serassi being a violent partizan of Tasso, but also unwilling to lose the credit of the discovery, copied the manuscript, but without any intention of publishing it, "till he could find leisure for replying properly to the sophistical and unfounded attacks of a critic so celebrated on other accounts." He announced his discovery as having been made "in one of the famous libraries at Rome," which vague indication he with some reason considered insufficient to lead to a second discovery. On Serassi's death his copy was found, containing a reference to the situation of the original; the criticisms were published, and form the greatest part of the last volume of the Milan edition of Galileo's works. The manuscript was imperfect at the time of this second discovery, several leaves having been torn out, it is not known by whom.

The opinion of the most judicious Italian critics appears to be, that it would have been more for Galileo's credit if these remarks had never been made public: they are written in a spirit of flippant violence, such as might not be extraordinary in a common juvenile critic, but which it is painful to notice from the pen of Galileo. Two or three sonnets are extant written by Galileo himself, and in two instances he has not scrupled to appropriate the conceits of the poet he affected to undervalue.* It should be mentioned that Galileo's matured taste rather receded from the violence of his early prejudices, for at a later period of his life he used to shun comparing the two; and when forced to give an opinion he said, "that Tasso's appeared the finer poem, but that Ariosto gave him the greater pleasure." Besides these sonnets, there is extant a short burlesque poem written by him, "In abuse of Gowns," when, on his first becoming Professor at Pisa, he found himself obliged by custom to wear his professional habit in every company. It is written not without humour, but does not bear comparison with Berni, whom he imitated.

There are several detached subjects treated of by Galileo, which may be noticed in this place. A letter by him containing the solution of a problem in Chances is probably the earliest notice extant of the application of mathematics to that interesting subject: the correspondence between Pascal and Fermat, with which its history is generally made to begin, not having taken place till at least twelve years later. There can be little doubt after the clear account of Carlo Dati, that Galileo was the first to examine the curve called the Cycloid, described by a point in the rim of a wheel rolling on a straight line, which he recommended as a graceful form for the arch of a bridge at Pisa. He even divined that the area contained between it and its base is exactly three times that of the generating circle. He seems to have been unable to verify this guess by strict geometrical reasoning, for Viviani tells an odd story, that in order to satisfy his doubts he cut out several large cycloids of pasteboard, but finding the weight in every trial to be rather less than three times that of the circle, he suspected the proportion to be irrational, and that there was some error in his estimation; the inquiry he abandoned was afterwards resumed with success by his pupil Torricelli.*

The account which Lagalla gives of an experiment shown in his presence by Galileo, carries the observation of the phosphorescence of the Bologna stone at least as far back as 1612.† Other writers mention the name of an alchymist, who according to them discovered it accidentally in 1603. Cesi, Lagalla, and one or two others, had passed the night at Galileo's house, with the intention of observing Venus and Saturn; but, the night being cloudy, the conversation turned on other matters, and especially on the nature of light, "on which Galileo took a small wooden box at daybreak before sunrise, and showed us some small stones in it, desiring us to observe that they were not in the least degree luminous. Having then exposed them for some time to the twilight, he shut the window again; and in the midst of the dark room showed us the stones, shining and glistening with a faint light, which we saw presently decay and become extinguished." In 1640, Liceti attempted to refer the effect of the earthshine upon the moon to a similar phosphorescent quality of that luminary, to which Galileo, then aged 76, replied by a long and able letter, enforcing the true explanation he had formerly given.

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* Compare Son. ii. v. 8 & 9; and Son. iii. v. 2 & 3, with Ger. Lib. c. iv. st. 76, and c. vii. st. 19.—The author gladly owns his obligation for these remarks to the kindness of Sig. Panizzi, Professor of Italian in the University of London.

* Lettera di Timauro Antiate. Firenze, 1663.

† De phænomenis in orbe Lunæ. Venetiis, 1612.

Although quite blind, and nearly deaf, the intellectual powers of Galileo remained to the end of his life; but he occasionally felt that he was overworking himself, and used to complain to his friend Micanzio that he found his head too busy for his body. "I cannot keep my restless brain from grinding on, although with great loss of time; for whatever idea comes into my head with respect to any novelty, drives out of it whatever I had been thinking of just before." He was busily engaged in considering the nature of the force of percussion, and Torricelli was employed in arranging his investigations for a continuation of the 'Dialogues on Motion,' when he was seized with an attack of fever and palpitation of the heart, which, after an illness of two months, put an end to his long, laborious, and useful life, on the 8th of January, 1642, just one year before his great successor Newton was born.

The malice of his enemies was scarcely allayed by his death. His right of making a will was disputed, as having died a prisoner to the Inquisition, as well as his right to burial in consecrated ground. These were at last conceded, but Urban anxiously interfered to prevent the design of erecting a monument to him in the church of Santa Croce, in Florence, for which a large sum had been subscribed. His body was accordingly buried in an obscure corner of the church, which for upwards of thirty years after his death was unmarked even by an inscription to his memory. It was not till a century later that the splendid monument was erected which now covers his and Viviani's remains. When their bodies were disinterred in 1737 for the purpose of being removed to their new resting-place, Capponi, the president of the Florentine Academy, in a spirit of spurious admiration, mutilated Galileo's body, by removing the thumb and fore-finger of the right-hand, and one of the vertebræ of the back, which are still preserved in some of the Italian museums. The monument was put up at the expense of his biographer, Nelli, to whom Viviani's property descended, charged with the condition of erecting it. Nor was this the only public testimony which Viviani gave of his attachment. The medal which he struck in honour of Galileo has already been mentioned; he also, as soon as it was safe to do so, covered every side of the house in which he lived with laudatory inscriptions to the same effect. A bust of Galileo was placed over the door, and two bas-reliefs on each side representing some of his principal discoveries. Not less than five other medals were struck in honour of him during his residence at Padua and Florence, which are all engraved in Venturi's Memoirs.

There are several good portraits of Galileo extant, two of which, by Titi and Subtermanns, are engraved in Nelli's Life of Galileo. Another by Subtermanns is in the Florentine Gallery, and an engraving from a copy of this is given by Venturi. There is also a very fine engraving from the original picture. An engraving from another original picture is in the frontispiece of the Padua edition of his works. Salusbury seems in the following passage to describe a portrait of Galileo painted by himself: "He did not contemn the other inferior arts, for he had a good hand in sculpture and carving; but his particular care was to paint well. By the pencil he described what his telescope discovered; in one he exceeded art, in the other, nature. Osorius, the eloquent bishop of Sylva, esteems one piece of Mendoza the wise Spanish minister's felicity, to have been this, that he was contemporary to Titian, and that by his hand he was drawn in a fair tablet. And Galilæus, lest he should want the same good fortune, made so great a progress in this curious art, that he became his own *Buonarota;* and because there was no other copy worthy of his pencil, drew himself." No other author makes the slightest allusion to such a painting; and it appears more likely that Salusbury should be mistaken than that so interesting a portrait should have been entirely lost sight of.

Galileo's house at Arcetri was standing in 1821, when Venturi visited it, and found it in the same state in which Galileo might be supposed to have left it. It is situated nearly a mile from Florence, on the south-eastern side, and about a gun-shot to the north-west of the convent of St. Matthew. Nelli placed a suitable inscription over the door of the house, which belonged in 1821 to a Signor Alimari.*

Although Nelli's Life of Galileo disappointed the expectations that had been formed of it, it is impossible for any admirer of Galileo not to feel the greatest degree of gratitude towards

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* Venturi.

him, for the successful activity with which he rescued so many records of the illustrious philosopher from destruction. After Galileo's death, the principal part of his books, manuscripts, and instruments, were put into the charge of Viviani, who was himself at that time an object of great suspicion; most of them he thought it prudent to conceal, till the superstitious outcries against Galileo should be silenced. At Viviani's death, he left his library, containing a very complete collection of the works of all the mathematicians who had preceded him (and amongst them those of Galileo, Torricelli, and Castelli, all which were enriched with notes and additions by himself), to the hospital of St. Mary at Florence, where an extensive library already existed. The directors of the hospital sold this unique collection in 1781, when it became entirely dispersed. The manuscripts in Viviani's possession passed to his nephew, the Abbé Panzanini, together with the portraits of the chief personages of the Galilean school, Galileo's instruments, and, among other curiosities, the emerald ring which he wore as a member of the Lyncean Academy. A great number of these books and manuscripts were purchased at different times by Nelli, after the death of Panzanini, from his relations, who were ignorant or regardless of their value. One of his chief acquisitions was made by an extraordinary accident, related by Tozzetti with the following details, which we repeat, as they seem to authenticate the story:—" In the spring of 1739, the famous Doctor Lami went out according to his custom to breakfast with some of his friends at the inn of the Bridge, by the starting-place; and as he and Sig. Nelli were passing through the market, it occurred to them to buy some Bologna sausages from the pork-butcher, Cioci, who was supposed to excel in making them. They went into the shop, had their sausages cut off and rolled in paper, which Nelli put into his hat. On reaching the inn, and calling for a plate to put them in, Nelli observed that the paper in which they had been rolled was one of Galileo's letters. He cleaned it as well as he could with his napkin, and put it into his pocket without saying a word to Lami; and as soon as he returned into the city, and could get clear of him, he flew to the shop of Cioci, who told him that a servant whom he did not know brought him from time to time similar letters, which he bought by weight as waste paper. Nelli bought all that remained, and on the servant's next reappearance in a few days, he learned the quarter whence they came, and after some time succeeded at a small expense in getting into his own possession an old corn-chest, containing all that still remained of the precious treasures which Viviani had concealed in it ninety years before."*

The earliest biographical notice of Galileo is that in the Obituary of the Mercurio Italico, published at Venice in 1647, by Vittorio Siri. It is very short, but contains an exact enumeration of his principal works and discoveries. Rossi, who wrote under the name of Janus Nicius Erythræus, introduced an account of Galileo in his Pinacotheca Imaginum Illustrium, in which the story of his illegitimacy first made its appearance. In 1664, Salusbury published a life of Galileo in the second volume of his Mathematical Collections, the greater part of which is a translation of Galileo's principal works. Almost the whole edition of the second volume of Salusbury's book was burnt in the great fire of London. Chauffepié says that only one copy is known to be extant in England: this is now in the well-known library of the Earl of Macclesfield, to whose kindness the author is much indebted for the use he has been allowed to make of this unique volume. A fragment of this second volume is in the Bodleian Library at Oxford. The translations in the preceding pages are mostly founded upon Salusbury's version. Salusbury's account, although that of an enthusiastic admirer of Galileo, is too prolix to be interesting: the general style of the performance may be guessed from the title of the first chapter—' Of Man in general, and how he excelleth all the other Animals.' After informing his readers that Galileo was born at Pisa, he proceeds:—" Italy is affirmed to have been the first that peopled the world after the universal deluge, being governed by Janus, Cameses, and Saturn, &c." His description of Galileo's childhood is somewhat quaint. " Before others had left making of dirt pyes, he was framing of diagrams; and whilst others were whipping of toppes, he was considering the cause of their motion." It is on the

* Notizie sul Ingrandimento delle Scienze Fisiche. Firenze, 1780.

whole tolerably correct, especially if we take into account that Salusbury had not yet seen Viviani's Life, though composed some years earlier.

The Life of Galileo by Viviani was first written as an outline of an intended larger work, but this latter was never completed. This sketch was published in the Memoirs of the Florentine Academy, of which Galileo had been one of the annual presidents, and afterwards prefixed to the complete editions of Galileo's works; it is written in a very agreeable and flowing style, and has been the groundwork of most subsequent accounts. Another original memoir by Niccolò Gherardini, was published by Tozzetti. A great number of references to authors who have treated of Galileo is given by Sach in his Onomasticon. An approved Latin memoir by Brenna is in the first volume of Fabroni's Vitæ Italorum Illustrium; he has however fallen into several errors: this same work contains the lives of several of his principal followers.

The article in Chauffepié's Continuation of Bayle's Dictionary does not contain anything which is not in the earlier accounts.

Andrès wrote an essay entitled 'Saggio sulla Filosofia del Galileo,' published at Mantua 1776; and Jagemann published his 'Geschichte des Leben des Galileo' at Leipzig, in 1787;* neither of these the author has been able to meet with. An analysis of the latter may be seen in Kästner's 'Geschichte der Mathematik, Göttingen, 1800,' from which it does not appear to contain any additional details. The 'Elogio del Galileo' by Paolo Frisi, first published at Leghorn in 1775, is, as its title expresses, rather in the nature of a panegyric than of a continuous biographical account. It is written with very great elegance and intimate knowledge of the subjects of which it treats. Nelli gave several curious particulars with respect to Galileo in his 'Saggio di Storia Letteraria Fiorentina, Lucca, 1759;' and in 1793 published his large work entitled 'Vita e Commercio Letterario di Galileo Galilei.' So uninteresting a book was probably never written from such excellent materials. Two thick quarto volumes are filled with repetitions of the accounts that were already in print, the bulky preparation of which compelled the author to forego the publication of the vast collection of original documents which his unwearied zeal and industry had collected. This defect has been in great measure supplied by Venturi in 1818 and 1821, who has not only incorporated in his work many of Nelli's manuscripts, but has brought together a number of scattered notices of Galileo and his writings from a variety of outlying sources—a service which the writer is able to appreciate from having gone through the greatest part of the same labour before he was fortunate enough to meet with Venturi's book. Still there are many letters cited by Nelli, which do not appear either in his book or Venturi's. Carlo Dati, in 1663, quotes "the registers of Galileo's correspondence arranged in alphabetical order, in ten large volumes."* The writer has no means of ascertaining what collection this may have been; it is difficult to suppose that one so arranged should have been lost sight of. It is understood that a life of Galileo is preparing at this moment in Florence, by desire of the present Grand Duke, which will probably throw much additional light on the character and merits of this great and useful philosopher.

The first editions of his various treatises, as mentioned by Nelli, are given below. Clement, in his 'Bibliothèque Curieuse,' has pointed out such among them, and the many others which have been printed, as have become rare.

The Florentine edition is the one used by the Academia della Crusca for their references; for which reason its paging is marked in the margin of the edition of Padua, which is much more complete, and is the one which has been on the present occasion principally consulted.

The latter contains the Dialogue on the System, which was not suffered to be printed in the former editions. The twelve first volumes of the last edition of Milan are a mere transcript of that of Padua: the thirteenth contains in addition the Letter to the Grand Duchess, the Commentary on Tasso, with some minor pieces. A complete edition is still wanted, embodying all the recently discovered documents, and omitting the verbose commentaries, which, however useful when they were written, now convey little information that cannot be more agreeably and more profitably learned in treatises of a later date.

* Venturi.

* Lettera di Timauro Antiate.

Such was the life, and such were the pursuits, of this extraordinary man. The numberless inventions of his acute industry; the use of the telescope, and the brilliant discoveries to which it led; the patient investigation of the laws of weight and motion; must all be looked upon as forming but a part of his real merits, as merely particular demonstrations of the spirit in which he everywhere withstood the despotism of ignorance, and appealed boldly from traditional opinions to the judgments of reason and common sense. He claimed and bequeathed to us the right of exercising our faculties in examining the beautiful creation which surrounds us. Idolized by his friends, he deserved their affection by numberless acts of kindness; by his good humour, his affability, and by the benevolent generosity with which he devoted himself and a great part of his limited income to advance their talents and fortunes. If an intense desire of being useful is everywhere worthy of honour; if its value is immeasurably increased, when united to genius of the highest order; if we feel for one who, notwithstanding such titles to regard, is harassed by cruel persecution,—then none deserve our sympathy, our admiration, and our gratitude, more than Galileo.

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## *List of Galileo's Works.*

| | | | |
|---|---|---|---|
| Le Operazioni del Compasso Geom. e Milit. | Padova, | 1606. | Fol. |
| Difesa di Gal. Galilei contr. all. cal. et impost. di Bald. Capra | Venezza, | 1607. | 4to. |
| Sydereus Nuncius | Venetiis, | 1610. | 4to. |
| Discorso int. alle cose che stanno in su l'Acqua | Firenze, | 1612. | 4to. |
| Novantiqua SS. PP. Doctrina de S. Scripturæ Testimoniis | Argent, | 1612. | 4to. |
| Istoria e Demostr. int. alle Macchie Solari | Roma, | 1613. | 4to. |
| Risp. alle oppos. del S. Lod. delle Colombe e del S. Vinc. di Grazia | Firenze, | 1615. | 4to. |
| Discorso delle Comete di Mario Guiducci | Firenze, | 1619. | 4to. |
| Dialogo sopra i due Massimi Sistemi del Mondo | Firenze, | 1632. | 4to. |
| Discorso e Demostr. intorno alle due nuove Scienze | Leida, | 1638. | 4to. |
| Della Scienza Meccanica | Ravenna, | 1649. | 4to. |
| Trattato della Sfera | Roma, | 1655. | 4to. |
| Discorso sopra il Flusso e Reflusso. (Scienze Fisiche di Tozzetti.) | Firenze, | 1780. | 4to. |
| Considerazioni sul Tasso | Roma, | 1793. | |
| Trattato della Fortificazione. (Memorie di Venturi.) | Modena, | 1818. | 4to. |

The editions of his collected works (in which is contained much that was never published separately) are—

| | | | |
|---|---|---|---|
| Opere di Gal. Galilei, Linc. Nob. Fior. &c. | Bologna, | 1656. | 2 vols. 4to. |
| Opere di Gal. Galilei, Nob. Fior. Accad. Linc. &c. | Firenze, | 1718. | 3 vols. 4to. |
| Opere di Gal. Galilei | Padova, | 1744. | 4 vols. 4to. |
| Opere di Gal. Galilei | Milano, | 1811. | 13 vols. 8vo. |

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## CORRECTIONS.

| *Page* | *Co.* | *Line.* |
|---|---|---|
| 5 | 1 | 2, *Add:* His instructor was the celebrated botanist, Andreas Cæsalpinus, who was professor of medicine at Pisa from 1567 to 1592. Hist. Acad. Pisan.; Pisis, 1791. |
| 8 | 2 | 18, *Add:* According to Kästner, his German name was Wursteisen. |
| 8 | 2 | 21, *for* 1588 *read* 1586. |
| 15 | 1 | 57, *for* 1632 read 1630. |
| 17 | 1 | 29. Salusbury alludes to the instrument described and figured in "The Use of the Sector, Crosse Staffe, and other Instruments. London, 1624." It is exactly Galileo's Compass. |
| 17 | 1 | 52, *for* Burg, a German, *read* Burgi, a Swiss. |
| 27 | 2 | 17. The author here called Brutti was an Englishman: his real name, perhaps, was Bruce. See p. 99. |
| 50 | 1 | 14. Kepler's Epitome was not published till 1619: it was then inserted in the Index. |
| 73 | 1 | 60, *for* under *read* turned from. |
| 80 | 1 | 50, *for* any *read* an indefinitely small. |

DRINKWATER [afterwards] BETHUNE, John Eliott

# LIFE OF KEPLER.

## Chapter I.

*Introduction—Birth and Education of Kepler—He is appointed Astronomical Professor at Gratz—Publishes the 'Mysterium Cosmographicum.'*

In the account of the life and discoveries of Galileo, we have endeavoured to inculcate the safety and fruitfulness of the method followed by that great reformer in his search after physical truth. As his success furnishes the best instance of the value of the inductive process, so the failures and blunders of his adversaries supply equally good examples of the dangers and the barrenness of the opposite course. The history of John Kepler might, at the first view, suggest conclusions somewhat inconsistent with this remark. Every one who is but moderately acquainted with astronomy is familiar with the discoveries which that science owes to him; the manner in which he made them is, perhaps, not so generally known. This extraordinary man pursued, almost invariably, the hypothetical method. His life was passed in speculating on the results of a few principles assumed by him, from very precarious analogies, as the causes of the phenomena actually observed in Nature. We nevertheless find that he did, in spite of this unphilosophical method, arrive at discoveries which have served as guides to some of the most valuable truths of modern science.

The difficulty will disappear if we attend more closely to the details of Kepler's investigations. We shall perceive that to an unusual degree of rashness in the formation of his systems, he added a quality very rarely possessed by philosophers of the hypothetical school. One of the greatest intellectual vices of the latter was a wilful blindness to the discrepancy of facts from their creed, a perverse and obstinate resistance to physical evidence, leading not unfrequently to an attempt at disguising the truth. From this besetting sin of the school, which from an intellectual fault often degenerated into a moral one, Kepler was absolutely free. Scheme after scheme, resting originally upon little beyond his own glowing imagination, but examined and endeared by the ceaseless labour of years, was unhesitatingly sacrificed, as soon as its insufficiency became indisputable, to make room for others as little deserving support. The history of philosophy affords no more remarkable instance of sincere uncompromising love of truth. To this virtue he owed his great discoveries: it must be attributed to his unhappy method that he made no more.

In considering this opinion upon the real nature of Kepler's title to fame, it ought not to be forgotten that he has exposed himself at a disadvantage on which certainly very few philosophers would venture. His singular candour allowed him to comment upon his own errors with the same freedom as if scrutinizing the work of a stranger; careless whether the impression on his readers were favourable or otherwise to himself, provided it was instructive. Few writers have spoken so much, and so freely of themselves, as Kepler. He records, on almost every occasion, the train of thought by which he was led to each of the discoveries that eventually repaid his perseverance; and he has thus given us a most curious and interesting view of the workings of a mind of great, though eccentric power. "In what follows," says he (when introducing a long string of suppositions, of which he had already discovered the fallacy), "let the reader pardon my credulity, whilst working out all these matters by my own ingenuity. For it is my opinion that the occasions by which men have acquired a knowledge of celestial phenomena are not less admirable than the discoveries themselves." Agreeing altogether with this opinion in its widest application, we have not scrupled, in the following sketch, to introduce at some length an account even of Kepler's erroneous speculations; they are in themselves very amusing, and will have the additional utility of proving the dangerous tendency of his method; they will show by how many absurd theories, and how

many years of wasted labour, his real discoveries and services to science lie surrounded.

JOHN KEPLER was born (as we are assured by his earliest biographer Hantsch) in long. 29° 7′, lat. 48° 54′, on the 21st day of December, 1571. On this spot stands the imperial city of Weil, in the duchy of Wirtemberg. His parents were Henry Kepler and Catherine Guldenmann, both of noble, though decayed families. Henry Kepler, at the time of his marriage, was a petty officer in the Duke of Wirtemberg's service; and a few years after the birth of his eldest son John, he joined the army then serving in the Netherlands. His wife followed him, leaving their son, then in his fifth year, at Leonberg, under the care of his grandfather. He was a seven months child, very weak and sickly; and after recovering with difficulty from a severe attack of small-pox, he was sent to school in 1577. Henry Kepler's limited income was still farther reduced on his return into Germany, the following year, in consequence of the absconding of one of his acquaintance, for whom he had incautiously become surety. His circumstances were so much narrowed by this misfortune, that he was obliged to sell his house, and nearly all that he possessed, and for several years he supported his family by keeping a tavern at Elmendingen. This occasioned great interruption to young Kepler's education; he was taken from school, and employed in menial services till his twelfth year, when he was again placed in the school at Elmendingen. In the following year he was again seized with a violent illness, so that his life was almost despaired of. In 1586, he was admitted into the monastic school of Maulbronn, where the cost of his education was defrayed by the Duke of Wirtemberg. This school was one of those established on the suppression of the monasteries at the Reformation, and the usual course of education followed there required that the students, after remaining a year in the superior classes, should offer themselves for examination at the college of Tubingen for the degree of bachelor: they then returned to their school with the title of veterans; and after completing the studies taught there, they were admitted as resident students at Tubingen, proceeded in about a year to the degree of master, and were then allowed to commence their course of theology. The three years of Kepler's life following his admission to Maulbronn, were marked by periodical returns of several of the disorders which had well nigh proved fatal to him in his childhood. During the same time disagreements arose between his parents, in consequence of which his father quitted his home, and soon after died abroad. After his father's departure, his mother also quarrelled with her relations, having been treated, says Hantsch, "with a degree of barbarity by her husband and brother-in-law that was hardly exceeded even by her own perverseness:" one of his brothers died, and the family-affairs were in the greatest confusion. Notwithstanding these disadvantages, Kepler took his degree of master in August 1591, attaining the second place in the annual examination. The first name on the list was John Hippolytus Brentius.

Whilst he was thus engaged at Tubingen, the astronomical lectureship at Gratz, the chief town of Styria, became vacant by the death of George Stadt, and the situation was offered to Kepler. Of this first occasion of turning his thoughts towards astronomy, he has himself given the following account: "As soon as I was of an age to feel the charms of philosophy, I embraced every part of it with intense desire, but paid no especial regard to astronomy. I had indeed capacity enough for it, and learned without difficulty the geometrical and astronomical theorems occurring in the usual course of the school, being well grounded in figures, numbers, and proportions. But those were compulsory studies—there was nothing to show a particular turn for astronomy. I was educated at the expense of the Duke of Wirtemberg, and when I saw such of my companions as the duke selected to send abroad shrink in various ways from their employments, out of fondness for home, I, who was more callous, had early made up my mind to go with the utmost readiness whithersoever I might be sent. The first offering itself was an astronomical post, which I was in fact forced to accept by the authority of my tutors; not that I was alarmed, in the manner I had condemned in others, by the remoteness of the situation, but by the unexpected and contemptible nature of the office, and by the slightness of my information in this branch of philosophy. I entered on it, therefore, better furnished with talent than knowledge: with many protestations that I was

not abandoning my claim to be provided for in some other more brilliant profession. What progress I made in the first two years of my studies, may be seen in my 'Mysterium Cosmographicum;' and the encouragement given me by my tutor, Mästlin, to take up the science of astronomy, may be read in the same book, and in his letter which is prefixed to the 'Narrative of Rheticus.' I looked on that discovery as of the highest importance, and still more so, because I saw how greatly it was approved by Mästlin."

The nature of the singular work to which Kepler thus refers with so much complacency, will be best shown by quoting some of the most remarkable parts of it, and especially the preface, in which he briefly details some of the theories he successively examined and rejected, before detecting (as he imagined he had here done) the true cause of the number and order of the heavenly bodies. The other branches of philosophy with which he occupied himself in his younger years, were those treated by Scaliger in his 'Exoteric Exercises,' to the study of which book Kepler attributed the formation of many of his opinions; and he tells us that he devoted much time "to the examination of the nature of heaven, of souls, of genii, of the elements, of the essence of fire, of the cause of fountains, the ebb and flow of the tide, the shape of the continents, and inland seas, and things of this sort." He also says, that by his first success with the heavens, his hopes were greatly inflamed of discovering similar analogies in the rest of the visible world, and for this reason, named his book merely a Prodromus, or Forerunner, meaning, at some future period, to subjoin the Aftercomer, or Sequel. But this intention was never fulfilled; either his imagination failed him, or, what is more likely, the laborious calculations in which his astronomical theories engaged him, left him little time for turning his attention to objects unconnected with his first pursuit.

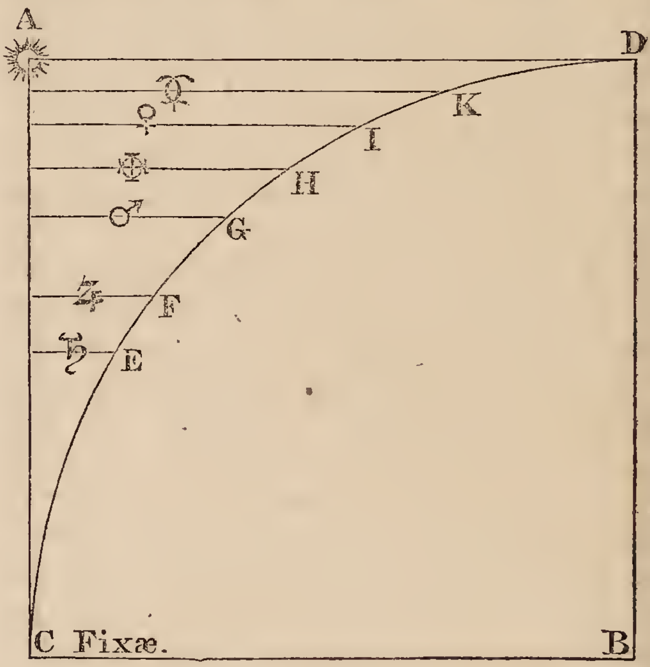
It is seldom that we are admitted to trace the progress of thought in those who have distinguished themselves by talent and originality; and although the whole of the following speculations begin and end in error, yet they are so characteristic, and exhibit such an extraordinary picture of the extravagances into which Kepler's lively imagination was continually hurrying him, that we cannot refrain from citing nearly the whole preface. From it, better than from any enumeration of peculiarities, the reader will at once apprehend the nature of his disposition.

"When I was attending the celebrated Mästlin, six years ago, at Tubingen, I was disturbed by the manifold inconveniences of the common theory of the universe, and so delighted with Copernicus, whom Mästlin was frequently in the habit of quoting with great respect, that I not only often defended his propositions in the physical disputations of the candidates, but also wrote a correct essay on the primary motion, maintaining, that it is caused by the rotation of the earth. And I was then at that point that I attributed to the earth the motion of the sun on physical (or, if you will, on metaphysical) grounds, as Copernicus had done for mathematical reasons. And, by this practice, I came by degrees, partly from Mästlin's instructions, and partly from my own efforts, to understand the superior mathematical convenience of the system of Copernicus beyond Ptolemy's. This labour might have been spared me, by Joachim Rheticus, who has shortly and clearly explained everything in his first Narrative. While incidentally engaged in these labours, in the intermission of my theology, it happened conveniently that I succeeded George Stadt in his situation at Gratz, where the nature of my office connected me more closely with these studies. Everything I had learned from Mästlin, or had acquired of myself, was there of great service to me in explaining the first elements of astronomy. And, as in Virgil, '*Fama mobilitate viget, viresque acquirit eundo,*' so it was with me, that the diligent thought on these things was the occasion of still further thinking: until, at last, in the year 1595, when I had some intermission of my lectures allowed me, I brooded with the whole energy of my mind on this subject. There were three things in particular, of which I pertinaciously sought the causes why they are not other than they are: the number, the size, and the motion of the orbits. I attempted the thing at first with numbers, and considered whether one of the orbits might be double, triple, quadruple, or any other multiple of the others, and how much, according to Copernicus, each differed from the rest. I spent a great deal of time in that labour, as if it were mere sport, but could find no equality either in the proportions or

the differences, and I gained nothing from this beyond imprinting deeply in my memory the distances as assigned by Copernicus; unless, perhaps, reader, this record of my various attempts may force your assent, backwards and forwards, as the waves of the sea; until tired at length, you will willingly repose yourself, as in a safe haven, on the reasons explained in this book. However, I was comforted in some degree, and my hopes of success were supported as well by other reasons which will follow presently, as by observing that the motions in every case seemed to be connected with the distances, and that where there was a great gap between the orbits, there was the same between the motions. And I reasoned, that if God had adapted motions to the orbits in some relation to the distances, it was probable that he had also arrayed the distances themselves in relation to something else.

"Finding no success by this method, I tried another, of singular audacity. I inserted a new planet between Mars and Jupiter, and another between Venus and Mercury, both of which I supposed invisible, perhaps on account of their smallness, and I attributed to each a certain period of revolution.* I thought that I could thus contrive some equality of proportions, increasing between every two, from the sun to the fixed stars. For instance, the Earth is nearer Venus in parts of the terrestrial orbit, than Mars is to the Earth in parts of the orbit of Mars. But not even the interposition of a new planet sufficed for the enormous gap between Mars and Jupiter; for the proportion of Jupiter to the new planet was still greater than that of Saturn to Jupiter. And although, by this supposition, I got some sort of a proportion, yet there was no reasonable conclusion, no certain determination of the number of the planets either towards the fixed stars, till we should get as far as them, nor ever towards the Sun, because the division in this proportion of the residuary space within Mercury might be continued without end. Nor could I form any conjecture, from the mobility of particular numbers, why, among an infinite number, so few should be moveable. The opinion advanced by Rheticus in his Narrative is improbable, where he reasons from the sanctity of the number six to the number of the six moveable heavens; for he who is inquiring of the frame of the world itself, must not derive reasons from these numbers, which have gained importance from things of later date.

"I sought again, in another way, whether the distance of every planet is not as the residuum of a sine; and its motion as the residuum of the sine of the complement in the same quadrant.




"Conceive the square A B to be constructed, whose side A C is equal to the semidiameter of the universe. From the angle B opposite to A the place of the sun, or centre of the world, describe the quadrant D C with the radius B C. Then in A C, the true radius of the world, let the sun, fixed stars, and planets be marked at their respective distances, and from these points draw lines parallel to B C, meeting the quadrant. I imagined the moving force acting on each of the planets to be in the proportion of these parallels. In the line of the sun is infinity, because A D is touched, and not cut, by the quadrant: therefore the moving force is infinite in the sun, as deriving no motion except from its own act. In Mercury the infinite line is cut off at K, and therefore at this point the motion is comparable with the others. In the fixed stars the line is altogether lost, and compressed into a mere point C; therefore at that point there is no moving force. This was the theorem, which was to be tried by cal-

* The following scrupulous note added by Kepler in 1621 to a subsequent edition of this work, deserves to be quoted. It shows how entirely superior he was to the paltriness of attempting to appropriate the discoveries of others, of which many of his contemporaries had exhibited instances even on slighter pretences than this passage might have afforded him. The note is as follows: "Not circulating round Jupiter like the Medicæan stars. Be not deceived. I never had them in my thoughts, but, like the other primary planets, including the sun in the centre of the system within their orbits."

culation; but if any one will reflect that two things were wanting to me, first, that I did not know the size of the *Sinus Totus*, that is, the radius of the proposed quadrant; secondly, that the energies of the motions were not thus expressed otherwise than in relation one to another; whoever, I say, well considers this, will doubt, not without reason, as to the progress I was likely to make in this difficult course. And yet, with unremitting labour, and an infinite reciprocation of sines and arcs, I did get so far as to be convinced that this theory could not hold.

"Almost the whole summer was lost in these annoying labours; at last, by a trifling accident, I lighted more nearly on the truth. I looked on it as an interposition of Providence, that I should obtain by chance, what I had failed to discover with my utmost exertions; and I believed this the more, because I prayed constantly that I might succeed, if Copernicus had really spoken the truth. It happened on the 9th or 19th* day of July, in the year 1595, that, having occasion to show, in my lecture-room, the passages of the great conjunctions through eight signs, and how they pass gradually from one trine aspect to another, I inscribed in a circle

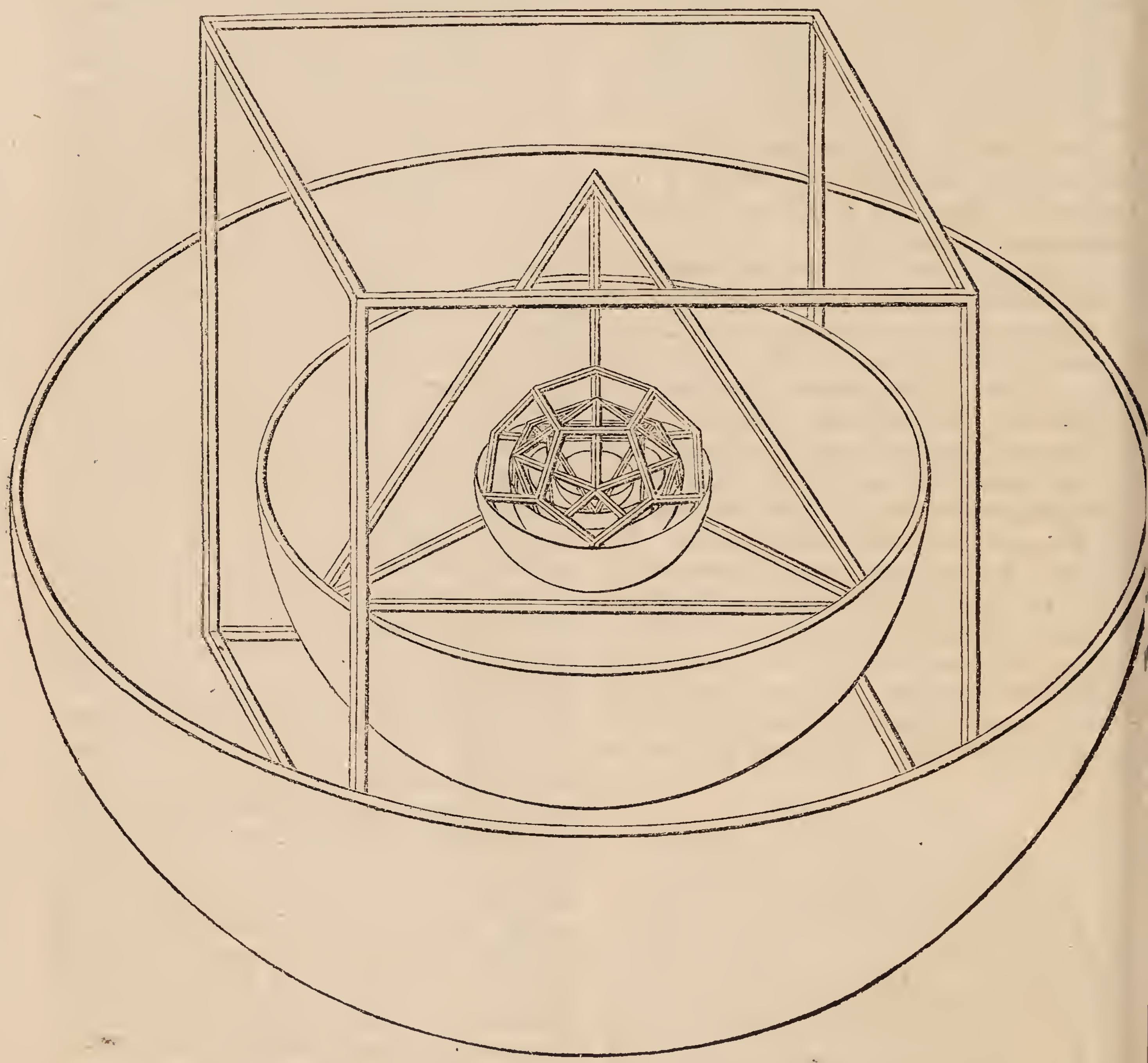

a great number of triangles, or quasi-triangles, so that the end of one was made the beginning of another. In this manner a smaller circle was shadowed out by the points in which the lines crossed each other.

"The radius of a circle inscribed in a triangle is half the radius of that described about it; therefore the proportion between these two circles struck the eye as almost identical with that between Saturn and Jupiter, and the triangle is the first figure, just as Saturn and Jupiter are the first planets. On the spot I tried the second distance between Jupiter and Mars with a square, the third with a pentagon, the fourth with a hexagon. And as the eye again cried out against the second distance between Jupiter and Mars, I combined the square with a triangle and a pentagon. There would be no end of mentioning every trial. The failure of this fruitless attempt was the beginning of the last fortunate one; for I reflected, that in this way I should never reach the sun, if I wished to observe the same rule throughout; nor should I have any reason why there were six, rather than twenty or a hundred moveable orbits. And yet figures pleased me, as being quantities, and as having existed before the heavens; for quantity was created with matter, and the heavens afterwards. But if (this was the current of my thoughts), in relation to the quantity and proportion of the six orbits, as Copernicus has determined them among the infinite other figures, five only could be found having peculiar properties above the rest, my business would be done. And then again it struck me, what have plane figures to do among solid orbits? Solid bodies ought rather to be introduced. This, reader, is the invention and the whole substance of this little work; for if any one, though but moderately skilled in geometry, should hear these words hinted, the five regular solids will directly occur to him with the proportions of their circumscribed and inscribed spheres: he has immediately before his eyes that scholium of Euclid to the 18th proposition of his 13th Book, in which it is proved to be impossible that there should be, or be imagined, more than five regular bodies.

"What is worthy of admiration (since I had then no proof of any prerogatives of the bodies with regard to their order) is, that employing a conjecture which was far from being subtle, derived from the distances of the planets, I should at once attain my end so happily in arranging them, that I was not able to change anything afterwards with the utmost exercise of my reasoning powers. In memory of the event, I write down here for you the sentence, just as it fell from me, and in the words in which it was that moment conceived:—The Earth is the

* This inconvenient mode of dating was necessary before the new or Gregorian style was universally adopted.

circle, the measurer of all; round it describe a dodecahedron, the circle including this will be Mars. Round Mars describe a tetrahedron, the circle including this will be Jupiter. Describe a cube round Jupiter, the circle including this will be Saturn. Now, inscribe in the Earth an icosaedron, the circle inscribed in it will be Venus. Inscribe an octaedron in Venus, the circle inscribed in it will be Mercury. This is the reason of the number of the planets.



"This was the cause, and such the success, of my labour: now read my propositions in this book. The intense pleasure I have received from this discovery never can be told in words. I regretted no more the time wasted; I tired of no labour; I shunned no toil of reckoning; days and nights I spent in calculations, until I could see whether this opinion would agree with the orbits of Copernicus, or whether my joy was to vanish into air. I willingly subjoin that sentiment of Archytas, as given by Cicero: 'If I could mount up into heaven, and thoroughly perceive the nature of the world, and beauty of the stars, that admiration would be without a charm for me, unless I had some one like you, reader, candid, attentive, and eager for knowledge, to whom to describe it.' If you acknowledge this feeling, and are candid, you will refrain from blame, such as not without cause I anticipate; but if, leaving that to itself, you fear lest these things be not ascertained, and that I have shouted triumph before victory, at least approach these pages, and learn the matter in consideration: you will not find, as just now, new and unknown planets interposed; that boldness of mine is not approved, but those old ones very little loosened, and so furnished by the interposition (however absurd you may think it) of rectilinear figures, that in future you may give a reason to the rustics when they ask for the hooks which keep the skies from falling.—Farewell."

In the third chapter Kepler mentions, that a thickness must be allowed to

each orb sufficient to include the greatest and least distance of the planet from the sun. The form and result of his comparison with the real distances are as follows:—

| | | | | | Book V. |
|---|---|---|---|---|---|
| If the inner surface of the orbit of | Saturn | be taken at 1000, then the outer one of | Jupiter = 577 | According to Copernicus they are | 635 Ch. 9 |
| | Jupiter | | Mars = 333 | | 333 — 14 |
| | Mars | | Earth = 795 | | 757 — 19 |
| | Earth | | Venus = 795 | | 794 — 21, 22 |
| | Venus | | Mercury = 577 | | 723 — 27 |

It will be observed, that Kepler's results were far from being entirely satisfactory; but he seems to have flattered himself, that the differences might be attributed to erroneous measurements. Indeed, the science of observation was then so much in its infancy, that such an assertion might be made without incurring much risk of decisive refutation.

Kepler next endeavoured to determine why the regular solids followed in this rather than any other order; and his imagination soon created a variety of essential distinctions between the cube, pyramid, and dodecahedron, belonging to the superior planets, and the other two.

The next question examined in the book, is the reason why the zodiac is divided into 360 degrees; and on this subject, he soon becomes enveloped in a variety of subtle considerations, (not very intelligible in the original, and still more difficult to explain shortly to others unacquainted with it,) in relation to the divisions of the musical scale; the origin of which he identifies with his five favourite solids. The twentieth chapter is appropriated to a more interesting inquiry, containing the first traces of his finally successful researches into the proportion between the distances of the planets, and the times of their motions round the sun. He begins with the generally admitted fact, that the more distant planets move more slowly; but in order to show that the proportion, whatever it may be, is not the simple one of the distances, he exhibits the following little Table:—

| | ♄ | ♃ | ♂ | ⊕ | ♀ | ☿ |
|---|---|---|---|---|---|---|
| | D. Scr. | | | | | |
| ♄ | 10759.12 | D. Scr. | | | | |
| ♃ | 6159 | 4332.37 | D.Scr. | | | |
| ♂ | 1785 | 1282 | 686.59 | D.Scr. | | |
| ⊕ | 1174 | 843 | 452 | 365.15 | D.Scr. | |
| ♀ | 844 | 606 | 325 | 262.30 | 224.42 | D.Scr. |
| ☿ | 434 | 312 | 167 | :35 | 115 | 87.58 |

At the head of each vertical column is placed the real time (in days and sexagesimal parts) of the revolution of the planet placed above it, and underneath the days due to the other inferior planets, if they observed the proportion of distance. Hence it appears that this proportion in every case gives a time greater than the truth; as for instance, if the earth's rate of revolution were to Jupiter's in the proportion of their distances, the second column shows that the time of her period would be 843 instead of 365¼ days; so of the rest. His next attempt was to compare them by two by two, in which he found that he arrived at a proportion something like the proportion of the distances, although as yet far from obtaining it exactly. This process amounts to taking the quotients obtained by dividing the period of each planet by the period of the one next beyond.

| | | | | |
|---|---|---|---|---|
| For if each of the Periods of | ♄ 10759.27 | be successively taken to consist of 1000 equal parts, the periods of the planet next below will contain of those parts in | ♃ 403 |
| | ♃ 4332.37 | | ♂ 159 |
| | ♂ 686.59 | | ⊕ 532 |
| | ⊕ 365.15 | | ♀ 615 |
| | ♀ 244.42 | | ☿ 392 |

| | |
|---|---|
| But if the distance of each planet in succession be taken to consist of 1000 equal parts, the distance of the next below will contain, according to Copernicus, in | ♃ 572 |
| | ♂ 290 |
| | ⊕ 658 |
| | ♀ 719 |
| | ☿ 500 |

From this table he argued that to make the proportions agree, we must assume one of two things, "either that the moving intelligences of the planets are weakest in those which are farthest from the Sun, or that there is one moving intelligence in the Sun, the common centre forcing them all round, but those most violently which are nearest, and that it languishes in some sort, and grows weaker at the most distant, because of the remoteness and the attenuation of the virtue."

We stop here to insert a note added by Kepler to the later editions, and shall take advantage of the same interruption to warn the reader not to confound this notion of Kepler with the theory of a gravitating force towards the Sun, in the sense in which we now use those words. According to our theory, the effect of the presence of the Sun upon the planet is to pull it towards the

centre in a straight line, and the effect of the motion thus produced combined with the motion of the planet, which if undisturbed would be in a straight line inclined to the direction of the radius, is, that it describes a curve round the Sun. Kepler considered his planets as perfectly quiet and unwilling to move when left alone; and that this virtue supposed by him to proceed in every direction out of the Sun, swept them round, just as the sails of a windmill would carry round anything which became entangled in them. In other parts of his works Kepler mentions having speculated on a real attractive force in the centre; but as he knew that the planets are not always at the same distance from the Sun, and conceived erroneously, that to remove them from their least to their greatest distance a repulsive force must be supposed alternating with an attractive one, he laid aside this notion as improbable. In a note he acknowledges that when he wrote the passage just quoted, imbued as he then was with Scaliger's notions on moving intelligences, he literally believed "that each planet was moved by a living spirit, but afterwards came to look on the moving cause as a corporeal though immaterial substance, something in the nature of light which is observed to diminish similarly at increased distances." He then proceeds as follows in the original text.

"Let us then assume, as is very probable, that motion is dispensed by the sun in the same manner as light. The proportion in which light emanating from a centre is diminished, is taught by optical writers: for there is the same quantity of light, or of the solar rays, in the small circles as in the large; and therefore, as it is more condensed in the former, more attenuated in the latter, a measure of the attenuation may be derived from the proportion of the circles themselves, both in the case of light and of the moving virtue. Therefore, by how much the orbit of Venus is greater than that of Mercury, in the same proportion will the motion of the latter be stronger, or more hurried, or more swift, or more powerful, or by whatever other word you like to express the fact, than that of the former. But a larger orbit would require a proportionably longer time of revolution, even though the moving force were the same. Hence it follows that the one cause of a greater distance of the planet from the Sun, produces a double effect in increasing the period, and conversely the increase of the periods will be double the difference of the distances. Therefore, half the increment added to the shorter period ought to give the true proportion of the distances, so that the sum should represent the distance of the superior planet, on the same scale on which the shorter period represents the distance of the inferior one. For instance, the period of Mercury is nearly 88 days; that of Venus is $224\frac{2}{3}$, the difference is $136\frac{2}{3}$: half of this is $68\frac{1}{3}$, which, added to 88, gives $156\frac{1}{3}$. The mean distance of Venus ought, therefore, to be, in proportion to that of Mercury, as $156\frac{1}{3}$ to 88. If this be done with all the planets, we get the following results, taking successively, as before, the distance of each planet at 1000.

| The distance in parts of which the distance of the next superior planet contains 1000, is at | | | But according to Copernicus they are respectively |
|---|---|---|---|
| | ♃ | 574 | 572 |
| | ♂ | 274 | 290 |
| | ⊕ | 694 | 658 |
| | ♀ | 762 | 719 |
| | ☿ | 563 | 500 |

As you see, we have now got nearer the truth."

Finding that this theory of the rate of diminution would not bring him quite close to the result he desired to find, Kepler immediately imagined another. This latter occasioned him a great deal of perplexity, and affords another of the frequently recurring instances of the waste of time and ingenuity occasioned by his impetuous and precipitate temperament. Assuming the distance of any planet, as for instance of Mars, to be the unit of space, and the virtue at that distance to be the unit of force, he supposed that as many particles as the virtue at the Earth gained upon that of Mars, so many particles of distance did the Earth lose. He endeavoured to determine the respective positions of the planets upon this theory, by the rules of false position, but was much astonished at finding the same exactly as on his former hypothesis. The fact was, as he himself discovered, although not until after several years, that he had become confused in his calculation; and when half through the process, had retraced his steps so as of course to arrive again at the numbers from which he started, and which he had taken from his former results. This was the real secret of the identity of the two methods; and if, when he had taken the distance of Mars at 1000, instead of assuming the distance of the earth at 694, as he did, he had taken any other number, and operated upon it in the same manner, he would

have had the same reason for relying on the accuracy of his supposition. As it was, the result utterly confounded him; and he was obliged to leave it with the remark, that "the two theories are thus proved to be the same in fact, and only different in form; although how that can possibly be, I have never to this day been able to understand."—His perplexity was very reasonable; they are by no means the same; it was only his method of juggling with the figures which seemed to connect them.

Notwithstanding all its faults, the genius and unwearied perseverance displayed by Kepler in this book, immediately ranked him among astronomers of the first class; and he received the most flattering encomiums from many of the most celebrated; among others, from Galileo and Tycho Brahe, whose opinion he invited upon his performance. Galileo contented himself with praising in general terms the ingenuity and good faith which appeared so conspicuously in it. Tycho Brahe entered into a more detailed criticism of the work, and, as Kepler shrewdly remarked, showed how highly he thought of it by advising him to try to adapt something of the same kind to the Tychonic system. Kepler also sent a copy of his book to the imperial astronomer, Raimar, with a complimentary letter, in which he exalted him above all other astronomers of the age. Raimar had surreptitiously acquired a notion of Tycho Brahe's theory, and published it as his own; and Tycho, in his letter, complained of Kepler's extravagant flattery. This drew a long apologetical reply from Kepler, in which he attributed the admiration he had expressed of Raimar to his own want of information at that time, having since met with many things in Euclid and Regiomontanus, which he then believed original in Raimar. With this explanation, Tycho professed himself perfectly satisfied.

## Chapter II.

*Kepler's Marriage—He joins Tycho Brahe at Prague—Is appointed Imperial Mathematician—Treatise on the New Star.*

The publication of this extraordinary book, early as it occurs in the history of Kepler's life, was yet preceded by his marriage. He had contemplated this step so early as 1592; but that suit having been broken off, he paid his addresses, in 1596, to Barbara Muller von Muhleckh. This lady was already a widow for the second time, although two years younger than Kepler himself. On occasion of this alliance he was required to prove the nobility of his family, and the delay consequent upon the inquiry postponed the marriage till the following year. He soon became involved in difficulties in consequence of this inconsiderate engagement: his wife's fortune was less than he had been led to expect, and he became embroiled on that account with her relations. Still more serious inconvenience resulted to him from the troubled state in which the province of Styria was at that time, arising out of the disputes in Bohemia and the two great religious parties into which the empire was now divided, the one headed by Rodolph, the feeble minded emperor,—the other by Matthias, his ambitious and enterprising brother.

In the year following his marriage, he thought it prudent, on account of some opinions he had unadvisedly promulgated, (of what nature does not very distinctly appear,) to withdraw himself from Gratz into Hungary. Thence he transmitted several short treatises to his friend Zehentmaier, at Tubingen—"On the Magnet," "On the Cause of the Obliquity of the Ecliptic," and "On the Divine Wisdom, as shown in the Creation." Little is known of these works beyond the notice taken of them in Zehentmaier's answers. Kepler has himself told us, that his magnetic philosophy was built upon the investigations of Gilbert, of whom he always justly spoke with the greatest respect.

About the same time a more violent persecution had driven Tycho Brahe from his observatory of Uraniburg, in the little island of Hueen, at the entrance of the Baltic. This had been bestowed on him by the munificence of Frederick I. of Denmark, who liberally furnished him with every means of prosecuting his astronomical observations. After Frederick's death, Tycho found himself unable to withstand the party which had constantly opposed him, and was forced, at a great loss and much inconvenience, to quit his favourite island. On the invitation of the emperor, Rudolph II., he then betook himself, after a short stay at Hamburg, to the castle of Benach, near Prague, which was assigned to him with an annual pension of three thousand florins, a truly munificent provision in those times and that country.

Kepler had been eager to see Tycho Brahe since the latter had intimated that his observations had led him to a more accurate determination of the excentricities of the orbits of the planets. By help of this, Kepler hoped that his theory might be made to accord more nearly with the truth; and on learning that Tycho was in Bohemia, he immediately set out to visit him, and arrived at Prague in January, 1600. From thence he wrote a second letter to Tycho, not having received the answer to his former apology, again excusing himself for the part he had appeared to take with Raimar against him. Tycho replied immediately in the kindest manner, and begged he would repair to him directly:—"Come not as a stranger, but as a very welcome friend; come and share in my observations with such instruments as I have with me, and as a dearly beloved associate." During his stay of three or four months at Benach, it was settled that Tycho should apply to the emperor, to procure him the situation of assistant in the observatory. Kepler then returned to Gratz, having previously received an intimation, that he might do so in safety. The plan, as it had been arranged between them was, that a letter should be procured from the emperor to the states of Styria, requesting that Kepler might join Tycho Brahe for two years, and retain his salary during that time: a hundred florins were to be added annually by the emperor, on account of the greater dearness of living at Prague. But before everything was concluded, Kepler finally threw up his situation at Gratz, in consequence of new dissensions. Fearing that this would utterly put an end to his hopes of connecting himself with Tycho, he determined to revive his claims on the patronage of the Duke of Wirtemberg. With this view he entered into correspondence with Mästlin and some of his other friends at Tubingen, intending to prosecute his medical studies, and offer himself for the professorship of medicine in that university. He was dissuaded from this scheme by the pressing instances of Tycho, who undertook to exert himself in procuring a permanent settlement for him from the emperor, and assured him, even if that attempt should fail, that the language he had used when formerly inviting him to visit him at Hamburg, should not be forgotten. In consequence of this encouragement, Kepler abandoned his former scheme, and travelled again with his wife to Prague. He was detained a long time on the road by violent illness, and his money became entirely exhausted. On this he wrote complainingly to Tycho, that he was unable without assistance to travel even the short distance which still separated them, far less to await much longer the fulfilment of the promises held out to him.

By his subsequent admissions, it appears that for a considerable time he lived entirely on Tycho's bounty, and by way of return, he wrote an essay against Raimar, and against a Scotchman named Liddell, professor at Rostoch and Helmstadt, who, like Raimar, had appropriated to himself the credit of the Tychonic system. Kepler never adopted this theory, and indeed, as the question merely regarded priority of invention, there could be no occasion, in the discussion, for an examination of its principles.

This was followed by a transaction, not much to Kepler's credit, who in the course of the following year, and during a second absence from Prague, fancied that he had some reason to complain of Tycho's behaviour, and wrote him a violent letter, filled with reproaches and insults. Tycho appears to have behaved in this affair with great moderation: professing to be himself occupied with the marriage of his daughter, he gave the care of replying to Kepler's charges, to Ericksen, one of his assistants, who, in a very kind and temperate letter, pointed out to him the ingratitude of his behaviour, and the groundlessness of his dissatisfaction. His principal complaint seems to have been, that Tycho had not sufficiently supplied his wife with money during his absence. Ericksen's letter produced an immediate and entire change in Kepler's temper, and it is only from the humble recantation which he instantaneously offered that we learn the extent of his previous violence. "Most noble Tycho," these are the words of his letter, "how shall I enumerate or rightly estimate your benefits conferred on me! For two months you have liberally and gratuitously maintained me, and my whole family; you have provided for all my wishes; you have done me every possible kindness; you have communicated to me everything you hold most dear; no one, by word or deed, has intentionally injured me in anything: in short,

not to your children, your wife, or yourself have you shown more indulgence than to me. This being so, as I am anxious to put upon record, I cannot reflect without consternation that I should have been so given up by God to my own intemperance, as to shut my eyes on all these benefits; that, instead of modest and respectful gratitude, I should indulge for three weeks in continual moroseness towards all your family, in headlong passion, and the utmost insolence towards yourself, who possess so many claims on my veneration from your noble family, your extraordinary learning, and distinguished reputation. Whatever I have said or written against the person, the fame, the honour, and the learning of your excellency; or whatever, in any other way, I have injuriously spoken or written, (if they admit no other more favourable interpretation,) as to my grief I have spoken and written many things, and more than I can remember; all and everything I recant, and freely and honestly declare and profess to be groundless, false, and incapable of proof." Hoffmann, the president of the states of Styria, who had taken Kepler to Prague on his first visit, exerted himself to perfect the reconciliation, and this hasty quarrel was entirely passed over.

On Kepler's return to Prague, in September, 1601, he was presented to the Emperor by Tycho, and honoured with the title of Imperial Mathematician, on condition of assisting Tycho in his calculations. Kepler desired nothing more than this condition, since Tycho was at that time probably the only person in the world who possessed observations sufficient for the reform which he now began to meditate in the theory of astronomy. Rudolph appears to have valued both Tycho Brahe and Kepler as astrologers rather than astronomers; but although unable to appreciate rightly the importance of the task they undertook, of compiling a new set of astronomical tables founded upon Tycho's observations, yet his vanity was flattered with the prospect of his name being connected with such a work, and he made liberal promises to defray the expense of the new Rudolphine Tables. Tycho's principal assistant at this time was Longomontanus, who altered his name to this form, according to the prevalent fashion of giving to every name a Latin termination. Lomborg or Longbierg was the name, not of his family, but of the village in Denmark, where he was born, just as Müller was seldom called by any other name than Regiomontanus, from his native town Königsberg, as George Joachim Rheticus was so surnamed from Rhetia, the country of the Grisons, and as Kepler himself was sometimes called Leonmontanus, from Leonberg, where he passed his infancy. It was agreed between Longomontanus and Kepler, that in discussing Tycho's observations, the former should apply himself especially to the Moon, and the latter to Mars, on which planet, owing to its favourable position, Tycho was then particularly engaged. The nature of these labours will be explained when we come to speak of the celebrated book "On the Motions of Mars."

This arrangement was disturbed by the return of Longomontanus into Denmark, where he had been offered an astronomical professorship, and still more by the sudden death of Tycho Brahe himself in the following October. Kepler attended him during his illness, and after his death undertook to arrange some of his writings. But, in consequence of a misunderstanding between him and Tycho's family, the manuscripts were taken out of his hands; and when, soon afterwards, the book appeared, Kepler complained heavily that they had published, without his consent or knowledge, the notes and interlineations added by him for his own private guidance whilst preparing it for publication.

On Tycho's death, Kepler succeeded him as principal mathematician to the emperor; but although he was thus nominally provided with a liberal salary, it was almost always in arrear. The pecuniary embarrassments in which he constantly found himself involved, drove him to the resource of gaining a livelihood by casting nativities. His peculiar temperament rendered him not averse from such speculations, and he enjoyed considerable reputation in this line, and received ample remuneration for his predictions. But although he did not scruple, when consulted, to avail himself in this manner of the credulity of his contemporaries, he passed over few occasions in his works of protesting against the futility of this particular genethliac astrology. His own astrological creed was in a different strain, more singular, but not less extravagant. We shall defer entering into any details concerning it, till we come to treat of his book on Harmonics, in which he has collected and

recapitulated the substance of his scattered opinions on this strange subject.

His next works deserving notice are those published on occasion of the new star which shone out with great splendour in 1604, in the constellation Cassiopeia *. Immediately on its appearance, Kepler wrote a short account of it in German, marked with all the oddity which characterises most of his productions. We shall see enough of his astronomical calculations when we come to his book on Mars; the following passage will probably be found more amusing.

After comparing this star with that of 1572, and mentioning that many persons who had seen it maintained this to be the brighter of the two, since it was nearly twice the size of its nearest neighbour, Jupiter, he proceeds as follows:—"Yonder one chose for its appearance a time no way remarkable, and came into the world quite unexpectedly, like an enemy storming a town, and breaking into the market-place before the citizens are aware of his approach; but ours has come exactly in the year of which astrologers have written so much about the fiery trigon that happens in it †; just in the month in which (according to Cyprian) Mars comes up to a very perfect conjunction with the other two superior planets; just in the day when Mars has joined Jupiter, and just in the place where this conjunction has taken place. Therefore the apparition of this star is not like a secret hostile irruption, as was that one of 1572, but the spectacle of a public triumph, or the entry of a mighty potentate; when the couriers ride in some time before, to prepare his lodgings, and the crowd of young urchins begin to think the time over-long to wait: then roll in, one after another, the ammunition, and money, and baggage waggons, and presently the trampling of horse, and the rush of people from every side to the streets and windows; and when the crowd have gazed with their jaws all agape at the troops of knights; then at last, the trumpeters, and archers, and lackeys, so distinguish the person of the monarch, that there is no occasion to point him out, but every one cries out of his own accord—'Here we have him!'—What it may portend is hard to determine, and thus much only is certain, that it comes to tell mankind either nothing at all, or high and weighty news, quite beyond human sense and understanding. It will have an important influence on political and social relations; not indeed by its own nature, but, as it were, accidentally through the disposition of mankind. First, it portends to the booksellers great disturbances, and tolerable gains; for almost every *Theologus*, *Philosophicus*, *Medicus*, and *Mathematicus*, or whoever else, having no laborious occupation intrusted to him, seeks his pleasure *in studiis*, will make particular remarks upon it, and will wish to bring these remarks to the light. Just so will others, learned and unlearned, wish to know its meaning, and they will buy the authors who profess to tell them. I mention these things merely by way of example, because, although thus much can be easily predicted without great skill, yet may it happen just as easily, and in the same manner, that the vulgar, or whoever else is of easy faith, or it may be, crazy, may wish to exalt himself into a great prophet; or it may even happen that some powerful lord, who has good foundation and beginning of great dignities, will be cheered on by this phenomenon to venture on some new scheme, just as if God had set up this star in the darkness merely to enlighten them."

It would hardly be supposed, from the tenor of this last passage, that the writer of it was not a determined enemy to astrological predictions of every description. In 1602 he had published a disputation, not now easily met with, "On the Principles of Astrology," in which it seems that he treated the professed astrologers with great severity. The essence of this book is probably contained in the second treatise on the new star, which he published in 1606*. In this volume he inveighs repeatedly against the vanity and worthlessness of ordinary astrology, declaring at the same time, that the professors of that art know that this judgment is pronounced by one well acquainted with its principles. "For if the vulgar are to pronounce who is the best astrologer, my reputation is known to be of the highest order; if they

* See Life of Galileo, p. 16.

† The fiery trigon occurs about once in every 800 years, when Saturn, Jupiter, and Mars are in the three fiery signs, Aries, Leo, and Sagittarius.

* The copy of this work in the British Museum is Kepler's presentation copy to our James I. On the blank leaf, opposite the title-page, is the following inscription, apparently in the author's handwriting:—"Regi philosophanti, philosophus serviens, Platoni Diogenes, Britannias tenenti, Pragæ stipem mendicans ab Alexandro, e dolio conductitio, hoc suum philosophema misit et commendavit."

prefer the judgment of the learned, they are already condemned. Whether they stand with me in the eyes of the populace, or I fall with them before the learned, in both cases I am in their ranks; I am on a level with them; I cannot be renounced."

The theory which Kepler proposed to substitute is intimated shortly in the following passage: "I maintain that the colours and aspects, and conjunctions of the planets, are impressed on the natures or faculties of sublunary things, and when they occur, that these are excited as well in forming as in moving the body over whose motion they preside. Now let no one conceive a prejudice that I am anxiously seeking to mend the deplorable and hopeless cause of astrology by far-fetched subtilties and miserable quibbling. I do not value it sufficiently, nor have I ever shunned having astrologers for my enemies. But a most unfailing experience (as far as can be hoped in natural phenomena) of the excitement of sublunary natures by the conjunctions and aspects of the planets, has instructed and compelled my unwilling belief."

After exhausting other topics suggested by this new star, he examines the different opinions on the cause of its appearance. Among others he mentions the Epicurean notion, that it was a fortuitous concourse of atoms, whose appearance in this form was merely one of the infinite number of ways in which, since the beginning of time, they have been combined. Having descanted for some time on this opinion, and declared himself altogether hostile to it, Kepler proceeds as follows:—"When I was a youth, with plenty of idle time on my hands, I was much taken with the vanity, of which some grown men are not ashamed, of making anagrams, by transposing the letters of my name, written in Greek, so as to make another sentence: out of Ιωάννης Κεπλῆρος I made Σειρήνων κάπηλος*; in Latin, out of *Joannes Keplerus* came *Serpens in akuleo*†. But not being satisfied with the meaning of these words, and being unable to make another, I trusted the thing to chance, and taking out of a pack of playing cards as many as there were letters in the name, I wrote one upon each, and then began to shuffle them, and at each shuffle to read them in the order they came, to see if any meaning came of it. Now, may all the Epicurean gods and goddesses confound this same chance, which, although I spent a good deal of time over it, never showed me anything like sense even from a distance*. So I gave up my cards to the Epicurean eternity, to be carried away into infinity, and, it is said, they are still flying about there, in the utmost confusion among the atoms, and have never yet come to any meaning. I will tell these disputants, my opponents, not my own opinion, but my wife's. Yesterday, when weary with writing, and my mind quite dusty with considering these atoms, I was called to supper, and a salad I had asked for was set before me. It seems then, said I aloud, that if pewter dishes, leaves of lettuce, grains of salt, drops of water, vinegar, and oil, and slices of egg, had been flying about in the air from all eternity, it might at last happen by chance that there would come a salad. Yes, says my wife, but not so nice and well dressed as this of mine is."

* The tapster of the Sirens.
† A serpent in his sting.

## Chapter III.

### *Kepler publishes his Supplement to Vitellion—Theory of Refraction.*

During several years Kepler remained, as he himself forcibly expressed it, begging his bread from the emperor at Prague, and the splendour of his nominal income served only to increase his irritation, at the real neglect under which he nevertheless persevered in his labours. His family was increasing, and he had little wherewith to support them beyond the uncertain proceeds of his writings and nativities. His salary was charged partly on the states of Silesia, partly on the imperial treasury; but it was in vain that repeated orders were procured for the payment of the arrears due to him. The resources of the empire were drained by the constant demands of an engrossing war, and Kepler had not sufficient influence to enforce his claims against those who thought even the smallest sum bestowed upon him ill spent, in fostering profitless speculations. In consequence of this niggardliness, Kepler was forced to postpone the publication of the Rudolphine Tables, which he was engaged in constructing from his own and Tycho Brahe's observations, and applied himself to other works of a less costly description. Among these may be men-

* In one of his anonymous writings Kepler has anagrammatized his name, *Joannes Keplerus*, in a variety of other forms, probably selected from the luckiest of his shuffles:—"*Kleopas Herennius, Helenor Kapuensis, Raspinus Enkeleo, Kanones Pueriles.*"

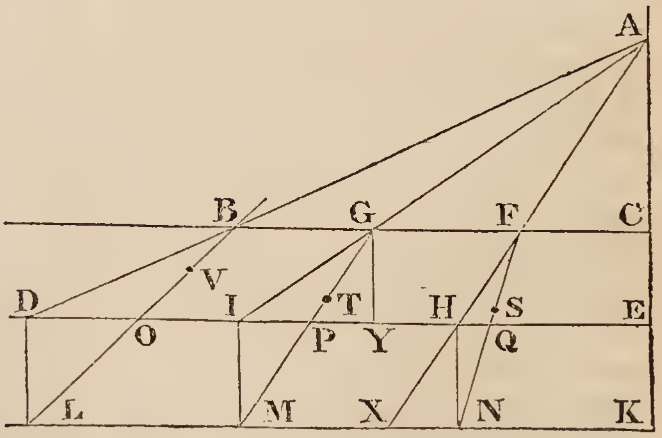
tioned a "Treatise on Comets," written on occasion of one which appeared in 1607: in this he suggests that they are planets moving in straight lines. The book published in 1604, which he entitles "A Supplement to Vitellion," may be considered as containing the first reasonable and consistent theory of optics, especially in that branch of it usually termed dioptrics, which relates to the theory of vision through transparent substances. In it was first explained the true use of the different parts of the eye, to the knowledge of which Baptista Porta had already approached very nearly, though he stopped short of the accurate truth. Kepler remarked the identity of the mechanism in the eye with that beautiful invention of Porta's, the camera obscura; showing, that the light which falls from external objects on the eye is refracted through a transparent substance, called, from its form and composition, the crystalline lens, and makes a picture on the fine net-work of nerves, called the retina, which lies at the back of the eye. The manner in which the existence of this coloured picture on the retina causes to the individual the sensation of sight, belongs to a theory not purely physical; and beyond this point Kepler did not attempt to go.

The direction into which rays of light (as they are usually called) are bent or refracted in passing through the air and other transparent substances or mediums, is discussed in this treatise at great length. Tycho Brahe had been the first astronomer who recognized the necessity of making some allowance on this account in the observed heights of the stars. A long controversy arose on this subject between Tycho Brahe and Rothman, the astronomer at Hesse Cassel, a man of unquestionable talent, but of odd and eccentric habits. Neither was altogether in the right, although Tycho had the advantage in the argument. He failed however to establish the true law of refraction, and Kepler has devoted a chapter to an examination of the same question. It is marked by precisely the same qualities as those appearing so conspicuously in his astronomical writings:—great ingenuity; wonderful perseverance; bad philosophy. That this may not be taken solely upon assertion, some samples of it are subjoined. The writings of the authors of this period are little read or known at the present day; and it is only by copious extracts that any accurate notion can be formed of the nature and value of their labours. The following tedious specimen of Kepler's mode of examining physical phenomena is advisedly selected to contrast with his astronomical researches: though the luck and consequently the fame that attended his divination were widely different on the two occasions, the method pursued was the same. After commenting on the points of difference between Rothman and Tycho Brahe, Kepler proceeds to enumerate his own endeavours to discover the law of refraction.

"I did not leave untried whether, by assuming a horizontal refraction according to the density of the medium, the rest would correspond with the sines of the distances from the vertical direction, but calculation proved that it was not so: and indeed there was no occasion to have tried it, for thus the refractions would increase according to the same law in all mediums, which is contradicted by experiment.

"The same kind of objection may be brought against the cause of refraction alleged by Alhazen and Vitellion. They say that the light seeks to be compensated for the loss sustained at the oblique impact; so that in proportion as it is enfeebled by striking against the denser medium, in the same degree does it restore its energy by approaching the perpendicular, that it may strike the bottom of the denser medium with greater force; for those impacts are most forcible which are direct. And they add some subtle notions, I know not what, how the motion of obliquely incident light is compounded of a motion perpendicular and a motion parallel to the dense surface, and that this compound motion is not destroyed, but only retarded by meeting the denser medium.

"I tried another way of measuring the refraction, which should include the density of the medium and the incidence:




for, since a denser medium is the cause of refraction, it seems to be the same thing as if we were to prolong the depth of the medium in which the rays are re-

fracted into as much space as would be filled by the denser medium under the force of the rarer one.

"Let A be the place of the light, B C the surface of the denser medium, D E its bottom. Let A B, A G, A F be rays falling obliquely, which would arrive at D, I, H, if the medium were uniform. But because it is denser, suppose the bottom to be depressed to K L, determined by this that there is as much of the denser matter contained in the space DC as of the rarer in LC: and thus, on the sinking of the whole bottom DE, the points D, I, H, E will descend vertically to L, M, N, K. Join the points B L, G M, F N, cutting D E in O, P, Q; the refracted rays will be A B O, A G P, A F Q."—"This method is refuted by experiment; it gives the refractions near the perpendicular A C too great in respect of those near the horizon. Whoever has leisure may verify this, either by calculation or compasses. It may be added that the reasoning itself is not very sure-footed, and, whilst seeking to measure other things, scarcely takes in and comprehends itself." This reflection must not be mistaken for the dawn of suspicion that his examination of philosophical questions began not altogether at the right end: it is merely an acknowledgment that he had not yet contrived a theory with which he was quite satisfied before it was disproved by experiment.

After some experience of Kepler's miraculous good fortune in seizing truths across the wildest and most absurd theories, it is not easy to keep clear of the opposite feeling of surprise whenever any of his extravagancies fail to discover to him some beautiful law of nature. But we must follow him as he plunges deeper in this unsuccessful inquiry; and the reader must remember, in order fully to appreciate this method of philosophizing, that it is almost certain that Kepler laboured upon every one of the gratuitous suppositions that he makes, until positive experiment satisfied him of their incorrectness.

"I go on to other methods. Since density is clearly connected with the cause of the refractions, and refraction itself seems a kind of compression of light, as it were, towards the perpendicular, it occurred to me to examine whether there was the same proportion between the mediums in respect of density and the parts of the bottom illuminated by the light, when let into a vessel, first empty, and afterwards filled with water. This mode branches out into many: for the proportion may be imagined, either in the straight lines, as if one should say that the line E Q, illuminated by refraction, is to EH illuminated directly, as the density of the one medium is to that of the other—Or another may suppose the proportion to be between F C and F H—Or it may be conceived to exist among surfaces, or so that some power of E Q should be to some power of E H in this proportion, or the circles or similar figures described on them. In this manner the proportion of E Q to E P would be double that of E H to EI—Or the proportion may be conceived existing among the solidities of the pyramidal frustums F H E C, F Q E C—Or, since the proportion of the mediums involves a threefold consideration, since they have density in length, breadth, and thickness, I proceeded also to examine the cubic proportions among the lines E Q, E H.

"I also considered other lines. From any of the points of refraction as G, let a perpendicular GY be dropped upon the bottom. It may become a question whether possibly the triangle I G Y, that is, the base I Y, is divided by the refracted ray G P, in the proportion of the densities of the mediums.

"I have put all these methods here together, because the same remark disproves them all. For, in whatever manner, whether as line, plane, or pyramid, E I observes a given proportion to E P, or the abbreviated line Y I to Y P, namely, the proportion of the mediums, it is sure that E I, the tangent of the distance of the point A from the vertex, will become infinite, and will, therefore make E P or Y P, also infinite. Therefore, I G P, the angle of refraction, will be entirely lost; and, as it approaches the horizon, will gradually become less and less, which is contrary to experiment.

"I tried again whether the images are equally removed from their points of refraction, and whether the ratio of the densities measures the least distance. For instance, supposing E to be the image, C the surface of the water, K the bottom, and C E to C K in the proportion of the densities of the mediums. Now, let F, G, B, be three other points of refraction and images at S, T, V, and let C E be equal to F S, G T, and B V. But according to this rule an image E would still be somewhat raised in the perpendicular A K, which is contrary to experiment, not to mention other

contradictions. Thirdly, whether the proportion of the mediums holds between F H and F X, supposing H to be the place of the image? Not at all. For so, C E would be in the same proportion to C K, so that the height of the image would always be the same, which we have just refuted. Fourthly, whether the raising of the image at E is to the raising at H, as C E to F H? Not in the least; for so the images either would never begin to be raised, or, having once begun, would at last be infinitely raised, because F H at last becomes infinite. Fifthly, whether the images rise in proportion to the sines of the inclinations? Not at all; for so the proportion of ascent would be the same in all mediums. Sixthly, are then the images raised at first, and in perpendicular radiation, according to the proportion of the mediums, and do they subsequently rise more and more according to the sines of the inclinations? For so the proportion would be compound, and would become different in different mediums. There is nothing in it: for the calculation disagreed with experiment. And generally it is in vain to have regard to the image or the place of the image, for that very reason, that it is imaginary. For there is no connexion between the density of the medium or any real quality or refraction of the light, and an accident of vision, by an error of which the image happens.

"Up to this point, therefore, I had followed a nearly blind mode of inquiry, and had trusted to good fortune; but now I opened the other eye, and hit upon a sure method, for I pondered the fact, that the image of a thing seen under water approaches closely to the true ratio of the refraction, and almost measures it; that it is low if the thing is viewed directly from above; that by degrees it rises as the eye passes towards the horizon of the water. Yet, on the other hand, the reason alleged above, proves that the measure is not to be sought in the image, because the image is not a thing actually existing, but arises from a deception of vision which is purely accidental. By a comparison of these conflicting arguments, it occurred to me at length, to seek the causes themselves of the existence of the image under water, and in these causes the measure of the refractions. This opinion was strengthened in me by seeing that opticians had not rightly pointed out the cause of the image which appears both in mirrors and in water. And this was the origin of that labour which I undertook in the third chapter. Nor, indeed, was that labour trifling, whilst hunting down false opinions of all sorts among the principles, in a matter rendered so intricate by the false traditions of optical writers; whilst striking out half a dozen different paths, and beginning anew the whole business. How often did it happen that a rash confidence made me look upon that which I sought with such ardour, as at length discovered!

"At length I cut this worse than Gordian knot of catoptrics by analogy alone, by considering what happens in mirrors, and what must happen analogically in water. In mirrors, the image appears at a distance from the real place of the object, not being itself material, but produced solely by reflection at the polished surface. Whence it followed in water also, that the images rise and approach the surface, not according to the law of the greater or less density in the water, as the view is less or more oblique, but solely because of the refraction of the ray of light passing from the object to the eye. On which assumption, it is plain that every attempt I had hitherto made to measure refractions by the image, and its elevation, must fall to the ground. And this became more evident when I discovered the true reason why the image is in the same perpendicular line with the object both in mirrors and in dense mediums. When I had succeeded thus far by analogy in this most difficult investigation, as to the place of the image, I began to follow out the analogy further, led on by the strong desire of measuring refraction. For I wished to get hold of some measure of some sort, no matter how blindly, having no fear but that so soon as the measure should be accurately known, the cause would plainly appear. I went to work as follows. In convex mirrors the image is diminished, and just so in rarer mediums; in denser mediums it is magnified, as in concave mirrors. In convex mirrors the central parts of the image approach, and recede in concave farther than towards the circumference; the same thing happens in different mediums, so that in water the bottom appears depressed, and the surrounding parts elevated. Hence it appears that a denser medium corresponds with a concave reflecting surface, and a rarer one with a convex one: it was clear, at the same time, that the plane surface of the

water affects a property of curvature. I was, therefore, to excogitate causes consistent with its having this effect of curvature, and to see if a reason could be given, why the parts of the water surrounding the incident perpendicular should represent a greater density than the parts just under the perpendicular. And so the thing came round again to my former attempts, which being refuted by reason and experiment, I was forced to abandon the search after a cause. I then proceeded to measurements."

Kepler then endeavoured to connect his measurements of different quantities of refraction with the conic sections, and was tolerably well pleased with some of his results. They were however not entirely satisfactory, on which he breaks off with the following sentence: "Now, reader, you and I have been detained sufficiently long whilst I have been attempting to collect into one faggot the measure of different refractions: I acknowledge that the cause cannot be connected with this mode of measurement: for what is there in common between refractions made at the plane surfaces of transparent mediums, and mixtilinear conic sections? Wherefore, *quod Deus bene vortat*, we will now have had enough of the causes of this measure; and although, even now, we are perhaps erring something from the truth, yet it is better, by working on, to show our industry, than our laziness by neglect."

Notwithstanding the great length of this extract, we must add the concluding paragraph of the Chapter, directed, as we are told in the margin, against the "Tychonomasticks:"—

"I know how many blind men at this day dispute about colours, and how they long for some one to give some assistance by argument to their rash insults of Tycho, and attacks upon this whole matter of refractions; who, if they had kept to themselves their puerile errors and naked ignorance, might have escaped censure; for that may happen to many great men. But since they venture forth publicly, and with thick books and sounding titles, lay baits for the applause of the unwary, (for now-a-days there is more danger from the abundance of bad books, than heretofore from the lack of good ones,) therefore let them know that a time is set for them publicly to amend their own errors. If they longer delay doing this, it shall be open, either to me or any other, to do to these unhappy meddlers in geometry as they have taken upon themselves to do with respect to men of the highest reputation. And although this labour will be despicable, from the vile nature of the follies against which it will be directed, yet so much more necessary than that which they have undertaken against others, as he is a greater public nuisance, who endeavours to slander good and necessary inventions, than he who fancies he has found what is impossible to discover. Meanwhile, let them cease to plume themselves on the silence which is another word for their own obscurity."

Although Kepler failed, as we have seen, to detect the true law of refraction, (which was discovered some years later by Willibrord Snell, a Flemish mathematician,) there are many things well deserving notice in his investigations. He remarked, that the quantity of refraction would alter, if the height of the atmosphere should vary; and also, that it would be different at different temperatures. Both these sources of variation are now constantly taken into account, the barometer and thermometer giving exact indications of these changes. There is also a very curious passage in one of his letters to Bregger, written in 1605, on the subject of the colours in the rainbow. It is in these words:—"Since every one sees a different rainbow, it is possible that some one may see a rainbow in the very place of my sight. In this case, the medium is coloured at the place of my vision, to which the solar ray comes to me through water, rain, or aqueous vapours. For the rainbow is seen when the sun is shining between rain, that is to say, when the sun also is visible. Why then do I not see the sun green, yellow, red, and blue, if vision takes place according to the mode of illumination? I will say something for you to attack or examine. The sun's rays are not coloured, except with a definite quantity of refraction. Whether you are in the optical chamber, or standing opposite glass globes, or walking in the morning dew, everywhere it is obvious that a certain and definite angle is observed, under which, when seen in dew, in glass, in water, the sun's splendour appears coloured, and under no other angle. There is no colouring by mere reflexion, without the refraction of a denser medium." How closely does Kepler appear, in this passage, to approach the discovery which forms not the least part of Newton's fame!

We also find in this work a defence of the opinion that the planets are lumi

nous of themselves; on the ground that the inferior planets would, on the contrary supposition, display phases like those of the moon when passing between us and the sun. The use of the telescope was not then known; and, when some years later the form of the disk of the planets was more clearly defined with their assistance, Kepler had the satisfaction of finding his assertions verified by the discoveries of Galileo, that these changes do actually take place. In another of his speculations, connected with the same subject, he was less fortunate. In 1607 a black spot appeared on the face of sun, such as may almost always be seen with the assistance of the telescope, although they are seldom large enough to be visible to the unassisted eye. Kepler saw it for a short time, and mistook it for the planet Mercury, and with his usual precipitancy hastened to publish an account of his observation of this rare phenomenon. A few years later, Galileo discovered with his glasses, a great number of similar spots; and Kepler immediately retracted the opinion announced in his treatise, and acknowledged his belief that previous accounts of the same occurrence which he had seen in old authors, and which he had found great difficulty in reconciling with his more accurate knowledge of the motions of Mercury, were to be referred to a like mistake. On this occasion of the invention of the telescope, Kepler's candour and real love of truth appeared in a most favourable light. Disregarding entirely the disagreeable necessity, in consequence of the discoveries of this new instrument, of retracting several opinions which he had maintained with considerable warmth, he ranged himself at once on the side of Galileo, in opposition to the bitter and determined hostility evinced by most of those whose theories were endangered by the new views thus offered of the heavens. Kepler's quarrel with his pupil, Horky, on this account, has been mentioned in the "Life of Galileo;" and this is only a selected instance from the numerous occasions on which he espoused the same unpopular side of the argument. He published a dissertation to accompany Galileo's "Intelligencer of the Stars," in which he warmly expressed his admiration of that illustrious inquirer into nature. His conduct in this respect was the more remarkable, as some of his most intimate friends had taken a very opposite view of Galileo's merit, and seem to have laboured much to disturb their mutual regard; Mästlin especially, Kepler's early instructor, seldom mentioned to him the name of Galileo, without some contemptuous expression of dislike. These statements have rather disturbed the chronological order of the account of Kepler's works. We now return to the year 1609, in which he published his great and extraordinary book, "On the Motions of Mars;" a work which holds the intermediate place, and is in truth the connecting link, between the discoveries of Copernicus and Newton.

## Chapter IV.

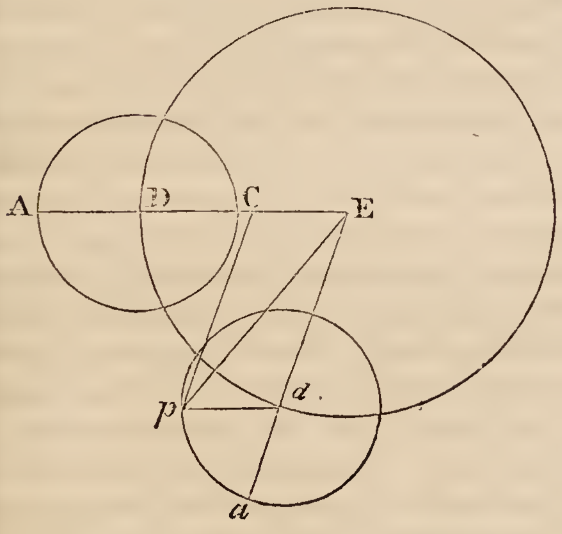
*Sketch of the Astronomical Theories before Kepler.*

Kepler had begun to labour upon these commentaries from the moment when he first made Tycho's acquaintance; and it is on this work that his reputation should be made mainly to rest. It is marked in many places with his characteristic precipitancy, and indeed one of the most important discoveries announced in it (famous among astronomers by the name of the Equable Description of Areas) was blundered upon by a lucky compensation of errors, of the nature of which Kepler remained ignorant to the very last. Yet there is more of the inductive method in this than in any of his other publications; and the unwearied perseverance with which he exhausted years in hunting down his often renewed theories, till at length he seemed to arrive at the true one, almost by having previously disproved every other, excites a feeling of astonishment nearly approaching to awe. It is wonderful how he contrived to retain his vivacity and creative fancy amongst the clouds of figures which he conjured up round him; for the slightest hint or shade of probability was sufficient to plunge him into the midst of the most laborious computations. He was by no means an accurate calculator, according to the following character which he has given of himself:—"Something of these delays must be attributed to my own temper, for *non omnia possumus omnes*, and I am totally unable to observe any order; what I do suddenly, I do confusedly, and if I produce any thing well arranged, it has been done ten times over. Sometimes an error of calculation committed by hurry, delays me a great length of time. I could indeed publish an infinity of things, for though my reading is confined, my imagination is abundant, but I grow dissatisfied with such confusion: I get disgusted and out of humour, and either throw them away, or put them aside to

be looked at again; or, in other words, to be written again, for that is generally the end of it. I entreat you, my friends, not to condemn me for ever to grind in the mill of mathematical calculations: allow me some time for philosophical speculations, my only delight."

He was very seldom able to afford the expense of maintaining an assistant, and was forced to go through most of the drudgery of his calculations by himself; and the most confirmed and merest arithmetician could not have toiled more doggedly than Kepler did in the work of which we are about to speak.

In order that the language of his astronomy may be understood, it is necessary to mention briefly some of the older theories. When it had been discovered that the planets did not move regularly round the earth, which was supposed to be fixed in the centre of the world, a mechanism was contrived by which it was thought that the apparent irregularity could be represented, and yet the principle of uniform motion, which was adhered to with superstitious reverence, might be preserved. This, in its simplest form, consisted in supposing the planet to move uniformly in a small circle, called an *epicycle*, the centre of which moved with an equal angular motion in the opposite direction round the earth*. The circle D $d$, described by D, the centre of the epicycle, was called the *deferent*. For instance, if the planet was supposed to be at A when the centre of the epicycle was at D, its

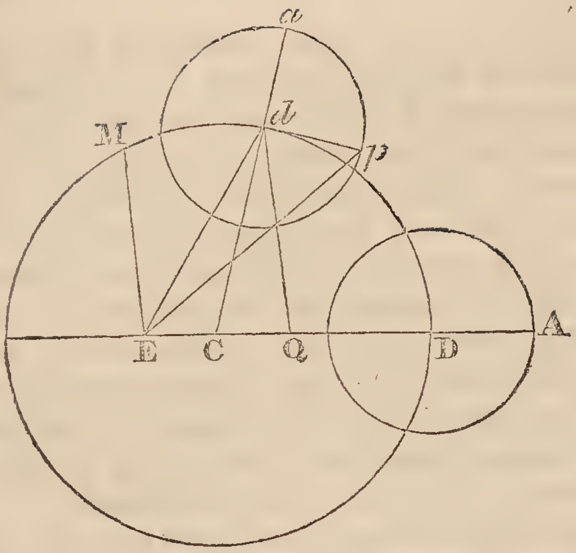



position, when the centre of the epicycle had removed to $d$, would be at $p$, found by drawing $d\,p$ parallel to D A. Thus, the angle $a\,d\,p$, measuring the motion of the planet in its epicycle, would be equal to D E $d$, the angle described by the centre of the epicycle in the deferent. The angle $p$ E $d$ between E $p$, the direction in which a planet so moving would be seen from the earth, supposed to be at E, and E $d$ the direction in which it would have been seen had it been moving in the centre of the deferent, was called the equation of the orbit, the word equation, in the language of astronomy, signifying what must be added or taken from an irregularly varying quantity to make it vary uniformly.

As the accuracy of observations increased, minor irregularities were discovered, which were attempted to be accounted for by making a second deferent of the epicycle, and making the centre of a second epicycle revolve in the circumference of the first, and so on, or else by supposing the revolution in the epicycle not to be completed in exactly the time in which its centre is carried round the deferent. Hipparchus was the first to make a remark by which the geometrical representation of these inequalities was considerably simplified. In fact, if E C be taken equal to $p\,d$, C $d$ will be a parallelogram, and consequently C $p$ equal to E $d$, so that the machinery of the first deferent and epicycle amounts to supposing that the planet revolves uniformly in a circle round the point C, not coincident with the place of the earth. This was consequently called the excentric theory, in opposition to the former or concentric one, and was received as a great improvement. As the point $d$ is not represented by this construction, the equation to the orbit was measured by the angle C $p$ E, which is equal to $p$ E $d$. It is not necessary to give any account of the manner in which the old astronomers determined the magnitudes and positions of these orbits, either in the concentric or excentric theory, the present object being little more than to explain the meaning of the terms it will be necessary to use in describing Kepler's investigations.

To explain the irregularities observed in the other planets, it became necessary to introduce another hypothesis, in adopting which the severity of the principle of uniform motion was somewhat relaxed. The machinery consisted partly of an excentric deferent round E, the earth, and on it an epicycle, in which the planet revolved uniformly; but the centre of the epicycle, instead of revolving uniformly round C, the centre of the deferent,

* By "the opposite direction" is meant, that while the motion in the circumference of one circle appeared, as viewed from its centre, to be from left to right, the other, viewed from its centre, appeared from right to left. This must be understood whenever these or similar expressions are repeated.




as it had hitherto been made to do, was supposed to move in its circumference with an uniform angular motion round a third point, Q; the necessary effect of which supposition was, that the linear motion of the centre of the epicycle ceased to be uniform. There were thus three points to be considered within the deferent; E, the place of the earth; C, the centre of the deferent, and sometimes called the centre of the orbit; and Q, called the centre of the equant, because, if any circle were described round Q, the planet would appear to a spectator at Q, to be moving equably in it. It was long uncertain what situation should be assigned to the centre of the equant, so as best to represent the irregularities to a spectator on the earth, until Ptolemy decided on placing it (in every case but that of Mercury, the observations on which were very doubtful) so that C, the centre of the orbit, lay just half way in the straight line, joining Q, the centre of equable motion, and E, the place of the earth. This is the famous principle, known by the name of the bisection of the excentricity.

The first equation required for the planet's motion was thus supposed to be due to the displacement of E, the earth, from Q, the centre of uniform motion, which was called the excentricity of the equant: it might be represented by the angle $d$ E M, drawing E M parallel to Q $d$; for clearly M would have been the place of the centre of the epicycle at the end of a time proportional to D $d$, had it moved with an equable angular motion round E instead of Q. This angle $d$ E M, or its equal E$d$Q, was called the equation of the centre (*i. e.* of the centre of the epicycle); and is clearly greater than if E Q, the excentricity of the equant, had been no greater than E C, called the excentricity of the orbit. The second equation was measured by the angle subtended at E by $d$, the centre of the epicycle, and $p$ the planet's place in its circumference: it was called indifferently the equation of the orbit, or of the argument. In order to account for the apparent stations and retrogradations of the planets, it became necessary to suppose that many revolutions in the latter were completed during one of the former. The variations of latitude of the planets were exhibited by supposing not only that the planes of their deferents were oblique to the plane of the ecliptic, and that the plane of the epicycle was also oblique to that of the deferent, but that the inclination of the two latter was continually changing, although Kepler doubts whether this latter complication was admitted by Ptolemy. In the inferior planets, it was even thought necessary to give to the plane of the epicycle two oscillatory motions on axes at right angles to each other.

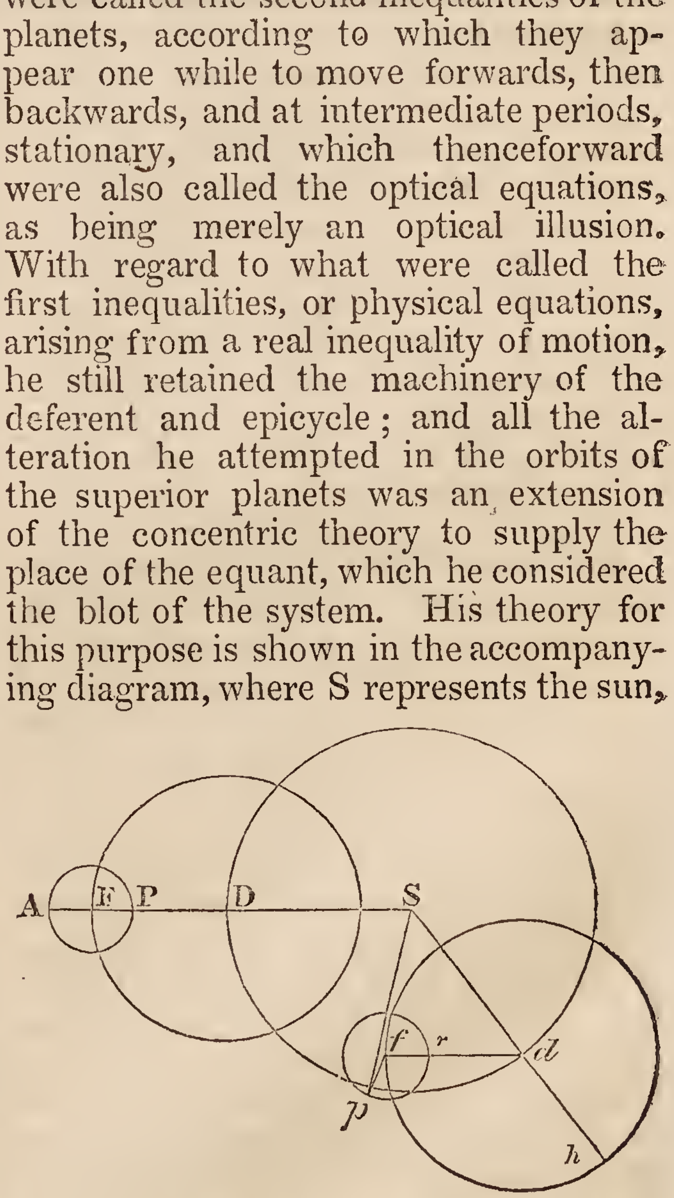
The astronomers at this period were much struck with a remarkable connexion between the revolutions of the superior planets in their epicycles, and the apparent motion of the sun; for when in conjunction with the sun, as seen from the earth, they were always found to be in the apogee, or point of greatest distance from the earth, of their epicycle; and when in opposition to the Sun, they were as regularly in the perigee, or point of nearest approach of the epicycle. This correspondence between two phenomena, which, according to the old astronomy, were entirely unconnected, was very perplexing, and it seems to have been one of the facts which led Copernicus to substitute the theory of the earth's motion round the sun.

As time wore on, the superstructure of excentrics and epicycles, which had been strained into representing the appearances of the heavens at a particular moment, grew out of shape, and the natural consequence of such an artificial system was, that it became next to impossible to foresee what ruin might be produced in a remote part of it by any attempt to repair the derangements and refit the parts to the changes, as they began to be remarked in any particular point. In the ninth century of our era, Ptolemy's tables were already useless, and all those that were contrived with unceasing toil to supply their place, rapidly became as unserviceable as they. Still the triumph of genius was seen in the veneration that continued to be paid to the assumptions of Ptolemy and Hipparchus; and even when the great reformer, Coper-

nicus, appeared, he did not for a long time intend to do more than slightly modify their principles. That which he found difficult in the Ptolemaic system, was none of the inconveniences by which, since the establishment of the new system, it has become common to demonstrate the inferiority of the old one; it was the displacement of the centre of the equant from the centre of the orbit that principally indisposed him against it, and led him to endeavour to represent the appearances by some other combinations of really uniform circular motions.

There was an old system, called the Egyptian, according to which Saturn, Jupiter, Mars, and the Sun circulated round the earth, the sun carrying with it, as two moons or satellites, the other two planets, Venus and Mercury. This system had never entirely lost credit: it had been maintained in the fifth century by Martianus Capella*, and indeed it was almost sanctioned, though not formally taught, by Ptolemy himself, when he made the mean motion of the sun the same as that of the centres of the epicycles of both these planets. The remark which had also been made by the old astronomers, of the connexion between the motion of the sun and the revolutions of the superior planets in their epicycles, led him straight to the expectation that he might, perhaps, produce the uniformity he sought by extending the Egyptian system to these also, and this appears to have been the shape in which his reform was originally projected. It was already allowed that the centre of the orbits of all the planets was not coincident with the earth, but removed from it by the space E C. This first change merely made E C the same for all the planets, and equal to the mean distance of the earth from the sun. This system afterwards acquired great celebrity through its adoption by Tycho Brahe, who believed it originated with himself. It might perhaps have been at this period of his researches, that Copernicus was struck with the passages in the Latin and Greek authors, to which he refers as testifying the existence of an old belief in the motion of the earth round the sun. He immediately recognised how much this alteration would further his principles of uniformity, by referring all the planetary motions to one centre, and did not hesitate to embrace it. The idea of explaining the daily and principal apparent motions of the heavenly bodies by the revolution of the earth on its axis, would be the concluding change, and became almost a necessary consequence of his previous improvements, as it was manifestly at variance with his principles to give to all the planets and starry worlds a rapid daily motion round the centre of the earth, now that the latter was removed from its former supposed post in the centre of the universe, and was itself carried with an annual motion round another fixed point.

The reader would, however, form an inaccurate notion of the system of Copernicus, if he supposed that it comprised no more than the theory that each planet, including the earth among them, revolved in a simple circular orbit round the sun. Copernicus was too well acquainted with the motions of the heavenly bodies, not to be aware that such orbits would not accurately represent them; the motion he attributed to the earth round the sun, was at first merely intended to account for those which were called the second inequalities of the planets, according to which they appear one while to move forwards, then backwards, and at intermediate periods, stationary, and which thenceforward were also called the optical equations, as being merely an optical illusion. With regard to what were called the first inequalities, or physical equations, arising from a real inequality of motion, he still retained the machinery of the deferent and epicycle; and all the alteration he attempted in the orbits of the superior planets was an extension of the concentric theory to supply the place of the equant, which he considered the blot of the system. His theory for this purpose is shown in the accompanying diagram, where S represents the sun,



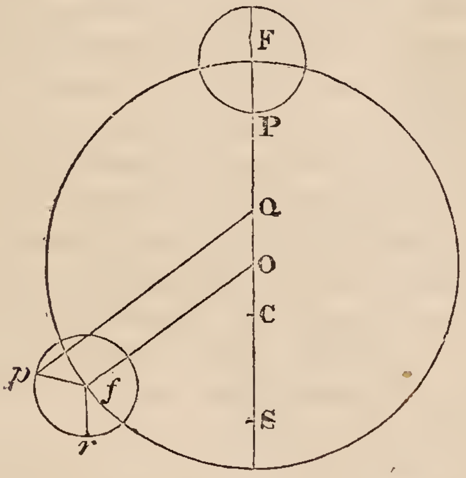

D $d$, the deferent or mean orbit of the

* Venus Mercuriusque, licet ortus occasusque quotidianos ostendunt, tamen eorum circuli terras omnino non ambiunt, sed circa solem laxiore ambitu circulantur. Denique circulorum suorum centron in sole constituunt.—De Nuptiis Philologiæ et Mercurii. Vicentiæ. 1499.

planet, on which revolves the centre of the great epicycle, whose radius, D F, was taken at $\frac{3}{4}$ of Ptolemy's excentricity of the equant; and round the circumference of this revolved, in the opposite direction, the centre of the little epicycle, whose radius, F P, was made equal to the remaining $\frac{1}{4}$ of the excentricity of the equant.

The planet P revolved in the circumference of the little epicycle, in the same direction with the centre of the great epicycle in the circumference of the deferent, but with a double angular velocity. The planet was supposed to be in the perigee of the little epicycle, when its centre was in the apogee of the greater; and whilst, for instance, D moved equably though the angle D S $d$, F moved through $h\,d\,f = $ D S $d$, and P through $r\,f\,p = 2$ D S $d$.

It is easy to show that this construction gives nearly the same result as Ptolemy's; for the deferent and great epicycle have been already shown exactly equivalent to an excentric circle round S, and indeed Copernicus latterly so represented it: the effect of his construction, as given above, may therefore be reproduced in the following simpler form, in which only the smaller epicycle is retained:




In this construction, the place of the planet is found at the end of any time proportional to F $f$, by drawing $f\,r$ parallel to S F, and taking $r\,f\,p = 2$ F $o\,f$. Hence it is plain, if we take O Q, equal to F P, (already assumed equal to $\frac{1}{4}$ of Ptolemy's excentricity of the equant,) since S O is equal to $\frac{3}{4}$ of the same, that S Q is the whole of Ptolemy's excentricity of the equant; and therefore, that Q is the position of the centre of his equant. It is also plain if we join Q $p$, since $r\,f\,p = 2$F $o\,f$, and $o$ Q $= f\,p$, that $p$ Q is parallel to $f\,o$, and, therefore, $p$ Q P is proportional to the time; so that the planet moves uniformly about the same point Q, as in Ptolemy's theory; and if we bisect S Q in C, which is the position of the centre of Ptolemy's deferent, the planet will, according to Copernicus, move very nearly, though not exactly, in the same circle, whose radius is C P, as that given by the simple excentric theory.

The explanation offered by Copernicus, of the motions of the inferior planets, differed again in form from that of the others. He here introduced what was called a *hypocycle*, which, in fact, was nothing but a deferent not including the sun, round which the centre of the orbit revolved. An epicycle in addition to the hypocycle was introduced into Mercury's orbit. In this epicycle he was not supposed to revolve, but to librate, or move up and down in its diameter. Copernicus had recourse to this complication to satisfy an erroneous assertion of Ptolemy with regard to some of Mercury's inequalities. He also retained the oscillatory motions ascribed by Ptolemy to the planes of the epicycles, in order to explain the unequal latitudes observed at the same distance from the nodes, or intersections of the orbit of the planet with the ecliptic. Into this intricacy, also, he was led by placing too much confidence in Ptolemy's observations, which he was unable to satisfy by an unvarying obliquity. Other very important errors, such as his belief that the line of nodes always coincided with the line of apsides, or places of greatest and least distance from the central body, (whereas, at that time, in the case of Mars, for instance, they were nearly 90° asunder,) prevented him from accurately representing many of the celestial phenomena.

These brief details may serve to show that the adoption or rejection of the theory of Copernicus was not altogether so simple a question as sometimes it may have been considered. It is, however, not a little remarkable, while it is strongly illustrative of the spirit of the times, that these very intricacies, with which Kepler's theories have enabled us to dispense, were the only parts of the system of Copernicus that were at first received with approbation. His theory of Mercury, especially, was considered a masterpiece of subtle invention. Owing to his dread of the unfavourable judgment he anticipated on the main principles of his system, his work remained unpublished during forty years, and was at last given to the world only just in time to allow Copernicus to receive the first copy of it a few hours before his death.

## Chapter V.

*Account of the Commentaries on the motions of Mars—Discovery of the Law of the equable description of Areas, and of Elliptic Orbits.*

We may now proceed to examine Kepler's innovations, but it would be doing injustice to one of the brightest points of his character, not to preface them by his own animated exhortation to his readers. "If any one be too dull to comprehend the science of astronomy, or too feeble-minded to believe in Copernicus without prejudice to his piety, my advice to such a one is, that he should quit the astronomical schools, and condemning, if he has a mind, any or all of the theories of philosophers, let him look to his own affairs, and leaving this worldly travail, let him go home and plough his fields: and as often as he lifts up to this goodly heaven those eyes with which alone he is able to see, let him pour out his heart in praises and thanksgiving to God the Creator; and let him not fear but he is offering a worship not less acceptable than his to whom God has granted to see yet more clearly with the eyes of his mind, and who both can and will praise his God for what he has so discovered."

Kepler did not by any means underrate the importance of his labours, as is sufficiently shewn by the sort of colloquial motto which he prefixed to his work. It consists in the first instance of an extract from the writings of the celebrated and unfortunate Peter Ramus. This distinguished philosopher was professor of mathematics in Paris, and in the passage in question, after calling on his contemporaries to turn their thoughts towards the establishment of a system of Astronomy unassisted by any hypothesis, he promised as an additional inducement to vacate his own chair in favour of any one who should succeed in this object. Ramus perished in the massacre of St. Bartholomew, and Kepler apostrophizes him as follows:—"It is well, Ramus, that you have forfeited your pledge, by quitting your life and professorship together: for if you still held it, I would certainly claim it as of right belonging to me on account of this work, as I could convince you even with your own logic." It was rather bold in Kepler to assert his claim to a reward held out for a theory resting on no hypothesis, by right of a work filled with hypotheses of the most startling description; but of the vast importance of this book there can be no doubt; and throughout the many wild and eccentric ideas to which we are introduced in the course of it, it is fit always to bear in mind that they form part of a work which is almost the basis of modern Astronomy."

The introduction contains a curious criticism of the commonly-received theory of gravity, accompanied with a declaration of Kepler's own opinions on the same subject. Some of the most remarkable passages in it have been already quoted in the life of Galileo; but, nevertheless, they are too important to Kepler's reputation to be omitted here, containing as they do a distinct and positive enunciation of the law of universal gravitation. It does not appear, however, that Kepler estimated rightly the importance of the theory here traced out by him, since on every other occasion he advocated principles with which it is scarcely reconcileable. The discussion is introduced in the following terms:—

"The motion of heavy bodies hinders many from believing that the earth is moved by an animal motion, or rather a magnetic one. Let such consider the following propositions. A mathematical point, whether the centre of the universe or not, has no power, either effectively or objectively, to move heavy bodies to approach it. Let physicians prove if they can, that such power can be possessed by a point, which neither is a body, nor is conceived unless by relation alone. It is impossible that the form* of a stone should, by moving its own body, seek a mathematical point, or in other words, the centre of the universe, without regard of the body in which that point exists. Let physicians prove if they can, that natural things have any sympathy with that which is nothing. Neither do heavy bodies tend to the centre of the universe by reason that they are avoiding the extremities of the round universe; for their distance from the centre is insensible, in proportion to their distance from the extremities of the universe. And what reason could there be for this hatred? How strong, how wise must those heavy bodies be, to be able to escape so carefully from an enemy lying on all sides of

* It is not very easy to carry the understanding aright among these Aristotelian ideas. Many at the present day might think they understood better what is meant, if for "form" had been written "nature."

them: what activity in the extremities of the world to press their enemy so closely! Neither are heavy bodies driven into the centre by the whirling of the first moveable, as happens in revolving water. For if we assume such a motion, either it would not be continued down to us, or otherwise we should feel it, and be carried away with it, and the earth also with us; nay, rather, we should be hurried away first, and the earth would follow; all which conclusions are allowed by our opponents to be absurd. It is therefore plain that the vulgar theory of gravity is erroneous.

The true theory of gravity is founded on the following axioms:—Every corporeal substance, so far forth as it is corporeal, has a natural fitness for resting in every place where it may be situated by itself beyond the sphere of influence of a body cognate with it. Gravity is a mutual affection between cognate bodies towards union or conjunction (similar in kind to the magnetic virtue), so that the earth attracts a stone much rather than the stone seeks the earth. Heavy bodies (if we begin by assuming the earth to be in the centre of the world) are not carried to the centre of the world in its quality of centre of the world, but as to the centre of a cognate round body, namely, the earth; so that wheresoever the earth may be placed, or whithersoever it may be carried by its animal faculty, heavy bodies will always be carried towards it. If the earth were not round, heavy bodies would not tend from every side in a straight line towards the centre of the earth, but to different points from different sides. If two stones were placed in any part of the world near each other, and beyond the sphere of influence of a third cognate body, these stones, like two magnetic needles, would come together in the intermediate point, each approaching the other by a space proportional to the comparative mass of the other. If the moon and earth were not retained in their orbits by their animal force or some other equivalent, the earth would mount to the moon by a fifty-fourth part of their distance, and the moon fall towards the earth through the other fifty-three parts and they would there meet; assuming however that the substance of both is of the same density. If the earth should cease to attract its waters to itself, all the waters of the sea would be raised and would flow to the body of the moon. The sphere of the attractive virtue which is in the moon extends as far as the earth, and entices up the waters; but as the moon flies rapidly across the zenith, and the waters cannot follow so quickly, a flow of the ocean is occasioned in the torrid zone towards the westward. If the attractive virtue of the moon extends as far as the earth, it follows with greater reason that the attractive virtue of the earth extends as far as the moon, and much farther; and in short, nothing which consists of earthly substance any how constituted, although thrown up to any height, can ever escape the powerful operation of this attractive virtue. Nothing which consists of corporeal matter is absolutely light, but that is comparatively lighter which is rarer, either by its own nature, or by accidental heat. And it is not to be thought that light bodies are escaping to the surface of the universe while they are carried upwards, or that they are not attracted by the earth. They are attracted, but in a less degree, and so are driven outwards by the heavy bodies; which being done, they stop, and are kept by the earth in their own place. But although the attractive virtue of the earth extends upwards, as has been said, so very far, yet if any stone should be at a distance great enough to become sensible, compared with the earth's diameter, it is true that on the motion of the earth such a stone would not follow altogether; its own force of resistance would be combined with the attractive force of the earth, and thus it would extricate itself in some degree from the motion of the earth."

Who, after perusing such passages in the works of an author, whose writings were in the hands of every student of astronomy, can believe that Newton waited for the fall of an apple to set him thinking for the first time on the theory which has immortalized his name? An apple may have fallen, and Newton may have seen it; but such speculations as those which it is asserted to have been the cause of originating in him had been long familiar to the thoughts of every one in Europe pretending to the name of natural philosopher.

As Kepler always professed to have derived his notion of a magnetic attraction among the planetary bodies from the writings of Gilbert, it may be worth while to insert here an extract from the "New Philosophy" of that author, to show in what form he presented a similar theory of the tides, which affords the

most striking illustration of that attraction. This work was not published till the middle of the seventeenth century, but a knowledge of its contents may, in several instances, be traced back to the period in which it was written :—

"There are two primary causes of the motion of the seas—the moon, and the diurnal revolution. The moon does not act on the seas by its rays or its light. How then? Certainly by the common effort of the bodies, and (to explain it by something similar) by their magnetic attraction. It should be known, in the first place, that the whole quantity of water is not contained in the sea and rivers, but that the mass of earth (I mean this globe) contains moisture and spirit much deeper even than the sea. The moon draws this out by sympathy, so that they burst forth on the arrival of the moon, in consequence of the attraction of that star; and for the same reason, the quicksands which are in the sea open themselves more, and perspire their moisture and spirits during the flow of the tide, and the whirlpools in the sea disgorge copious waters; and as the star retires, they devour the same again, and attract the spirits and moisture of the terrestrial globe. Hence the moon attracts, not so much the sea as the subterranean spirits and humours; and the interposed earth has no more power of resistance than a table or any other dense body has to resist the force of a magnet. The sea rises from the greatest depths, in consequence of the ascending humours and spirits; and when it is raised up, it necessarily flows on to the shores, and from the shores it enters the rivers."*

This passage sets in the strongest light one of the most notorious errors of the older philosophy, to which Kepler himself was remarkably addicted. If Gilbert had asserted, in direct terms, that the moon attracted the water, it is certain that the notion would have been stigmatized (as it was for a long time in Newton's hands) as arbitrary, occult, and unphilosophical: the idea of these subterranean humours was likely to be treated with much more indulgence. A simple statement, that when the moon was over the water the latter had a tendency to rise towards it, was thought to convey no instruction; but the assertion that the moon draws out subterranean spirits by sympathy, carried with it a more imposing appearance of theory. The farther removed these humours were from common experience, the easier it became to discuss them in vague and general language; and those who called themselves philosophers could endure to hear attributes bestowed on these fictitious elements which revolted their imaginations when applied to things of whose reality at least some evidence existed.

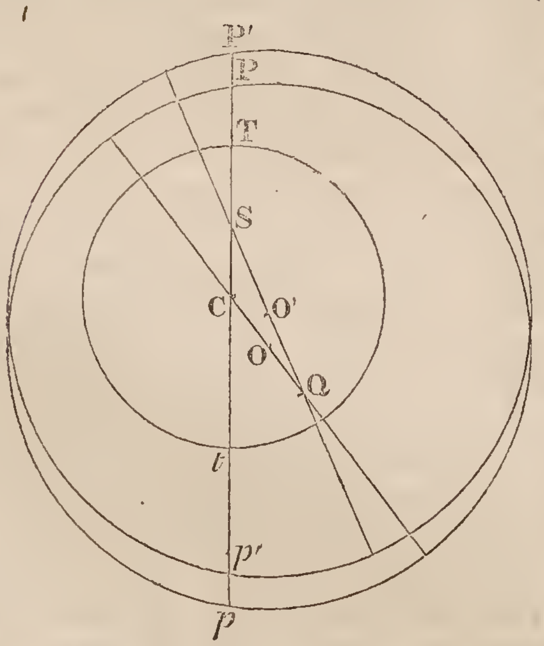
It is not necessary to dwell upon the system of Tycho Brahe, which was identical, as we have said, with one rejected by Copernicus, and consisted in making the sun revolve about the earth, carrying with it all the other planets revolving about him. Tycho went so far as to deny the rotation of the earth to explain the vicissitudes of day and night, but even his favourite assistant Longomontanus differed from him in this part of his theory. The great merit of Tycho Brahe, and the service he rendered to astronomy, was entirely independent of any theory; consisting in the vast accumulation of observations made by him during a residence of fifteen years at Uraniburg, with the assistance of instruments, and with a degree of care, very far superior to anything known before his time in practical astronomy. Kepler is careful repeatedly to remind us, that without Tycho's observations he could have done nothing. The degree of reliance that might be placed on the results obtained by observers who acknowledged their inferiority to Tycho Brahe, may be gathered from an incidental remark of Kepler to Longomontanus. He had been examining Tycho's registers, and had occasionally found a difference amounting sometimes to 4′ in the right ascensions of the same planet, deduced from different stars on the same night. Longomontanus could not deny the fact, but declared that it was impossible to be always correct within such limits. The reader should never lose sight of this uncertainty in the observations, when endeavouring to estimate the difficulty of finding a theory that would properly represent them.

When Kepler first joined Tycho Brahe at Prague, he found him and Longomontanus very busily engaged in correcting the theory of Mars, and accordingly it was this planet to which he also first directed his attention. They had formed a catalogue of the mean oppositions of Mars during twenty years, and had discovered a position of the equant, which (as they said) represented them with tolerable

* De mundo nostro sublunari, Philosophia Nova. Amstelodami, 1651.

exactness. On the other hand, they were much embarrassed by the unexpected difficulties they met in applying a system which seemed on the one hand so accurate, to the determination of the latitudes, with which it could in no way be made to agree. Kepler had already suspected the cause of this imperfection, and was confirmed in the view he took of their theory, when, on a more careful examination, he found that they overrated the accuracy even of their longitudes. The errors in these, instead of amounting as they said, nearly to 2′, rose sometimes above 21′. In fact they had reasoned ill on their own principles, and even if the foundations of their theory had been correctly laid, could not have arrived at true results. But Kepler had satisfied himself of the contrary, and the following diagram shews the nature of the first alteration he introduced, not perhaps so celebrated as some of his later discoveries, but at least of equal consequence to astronomy, which could never have been extricated from the confusion into which it had fallen, till this important change had been effected.

The practice of Tycho Brahe, indeed of all astronomers till the time of Kepler, had been to fix the position of the planet's orbit and equant from observations on its mean oppositions, that is to say, on the times when it was precisely six signs or half a circle distant from the mean place of the sun. In the annexed figure, let S represent the sun, C the centre of the earth's orbit, T *t*.




Tycho Brahe's practice amounted to this, that if Q were supposed the place of the centre of the planet's equant, the centre of P *p* its orbit was taken in Q C, and not in Q S, as Kepler suggested that it ought to be taken. The consequence of this erroneous practice was, that the observations were deprived of the character for which oppositions were selected, of being entirely free from the second inequalities. It followed therefore that as part of the second inequalities were made conducive towards fixing the relative position of the orbit and equant, to which they did not naturally belong, there was an additional perplexity in accounting for the remainder of them by the size and motion of the epicycle. As the line of nodes of every planet was also made to pass through C instead of S, there could not fail to be corresponding errors in the latitudes. It would only be in the rare case of an opposition of the planet in the line C S, that the time of its taking place would be the same, whether O, the centre of the orbit, was placed in C Q or S Q. Every other opposition would involve an error, so much the greater as it was observed at a greater distance from the line C S.

It was long however before Tycho Brahe could be made to acquiesce in the propriety of the proposed alteration; and, in order to remove his doubts as to the possibility that a method could be erroneous which, as he still thought, had given him such accurate longitudes, Kepler undertook the ungrateful labour of the first part of his "Commentaries." He there shewed, in the three systems of Copernicus, Tycho Brahe, and Ptolemy, and in both the concentric and excentric theories, that though a false position were given to the orbit, the longitudes of a planet might be so represented, by a proper position of the centre of the equant, as never to err in oppositions above 5′ from those given by observation; though the second inequalities and the latitudes would thereby be very greatly deranged.

The change Kepler introduced, of observing apparent instead of mean oppositions, made it necessary to be very accurate in his reductions of the planet's place to the ecliptic; and in order to be able to do this, a previous knowledge of the parallax of Mars became indispensable. His next labour was therefore directed to this point; and finding that the assistants to whom Tycho Brahe had previously committed this labour had performed it in a negligent and imperfect manner, he began afresh with Tycho's original observations. Having satisfied himself as to the probable limits of his errors in the parallax on which he finally fixed, he proceeded to determine the inclination of the orbit and

the position of the line of nodes. In all these operations his talent for astronomical inquiries appeared pre-eminent in a variety of new methods by which he combined and availed himself of the observations; but it must be sufficient merely to mention this fact, without entering into any detail. One important result may be mentioned, at which he arrived in the course of them, the constancy of the inclination of the planet's orbit, which naturally strengthened him in his new theory.

Having gone through these preliminary inquiries, he came at last to fix the proportions of the orbit; and, in doing so, he determined, in the first instance, not to assume, as Ptolemy appeared to have done arbitrarily, the bisection of the excentricity, but to investigate its proportion along with the other elements of the orbit, which resolution involved him in much more laborious calculations. After he had gone over all the steps of his theory no less than seventy times—an appalling labour, especially if we remember that logarithms were not then invented—his final result was, that in 1587, on the 6th of March, at $7^h\ 23'$, the longitude of the aphelion of Mars was $4^s\ 28°\ 48'\ 55''$; that the planet's mean longitude was $6^s\ 0°\ 51'\ 35''$; that if the semidiameter of the orbit was taken at 100000, the excentricity was 11332; and the excentricity of the equant 18564. He fixed the radius of the greater epicycle at 14988, and that of the smaller at 3628.

When he came to compare the longitudes as given by this, which he afterwards called the *vicarious* theory, with the observations at opposition, the result seemed to promise him the most brilliant success. His greatest error did not exceed $2'$; but, notwithstanding these flattering anticipations, he soon found by a comparison of longitudes out of opposition and of latitudes, that it was yet far from being so complete as he had imagined, and to his infinite vexation he soon found that the labour of four years, which he had expended on this theory, must be considered almost entirely fruitless. Even his favourite principle of dividing the excentricity in a different ratio from Ptolemy, was found to lead him into greater error than if he had retained the old bisection. By restoring that, he made his latitudes more accurate, but produced a corresponding change for the worse in his longitudes; and although the errors of $8'$, to which they now amounted, would probably have been disregarded by former theorists, Kepler could not remain satisfied till they were accounted for. Accordingly he found himself forced to the conclusion that one of the two principles on which this theory rested must be erroneous; either the orbit of the planet is not a perfect circle, or there is no fixed point within it round which it moves with an uniform angular motion. He had once before admitted the possibility of the former of these facts, conceiving it possible that the motion of the planets is not at all curvilinear, but that they move in polygons round the sun, a notion to which he probably inclined in consequence of his favourite harmonics and geometrical figures.

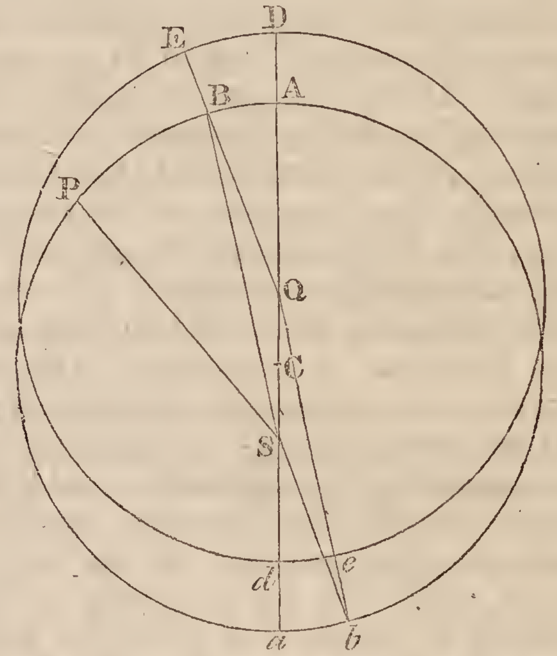
In consequence of the failure of a theory conducted with such care in all its practical details, Kepler determined that his next trial should be of an entirely different complexion. Instead of first satisfying the first inequalities of the planet, and then endeavouring to account for the second inequalities, he resolved to reverse the process, or, in other words, to ascertain as accurately as possible what part of the planet's apparent motion should be referred solely to the optical illusion produced by the motion of the earth, before proceeding to any inquiry of the real inequality of the planet's proper motion. It had been hitherto taken for granted, that the earth moved equably round the centre of its orbit; but Kepler, on resuming the consideration of it, recurred to an opinion he had entertained very early in his astronomical career (rather from his conviction of the existence of general laws, than that he had then felt the want of such a supposition), that it required an equant distinct from its orbit no less than the other planets. He now saw, that if this were admitted, the changes it would everywhere introduce in the optical part of the planet's irregularities might perhaps relieve him from the perplexity in which the vicarious theory had involved him. Accordingly he applied himself with renewed assiduity to the examination of this important question, and the result of his calculations (founded principally on observations of Mars' parallax) soon satisfied him not only that the earth's orbit does require such an equant, but that its centre is placed according to the general law of the bisection of the excentricity which he had previously found

indispensable in the other planets. This was an innovation of the first magnitude, and accordingly Kepler did not venture to proceed farther in his theory, till by evidence of the most varied and satisfactory nature, he had established it beyond the possibility of cavil.

It may be here remarked, that this principle of the bisection of the eccentricity, so familiar to the Ptolemaic astronomers, is identical with the theory afterwards known by the name of the simple elliptic hypothesis, advocated by Seth Ward and others. That hypothesis consisted in supposing the sun to be placed in one focus of the elliptic orbit of the planet, whose angular motion was uniform round the other focus. In Ptolemaic phraseology, that other focus was the centre of the equant, and it is well known that the centre of the ellipse lies in the middle point between the two foci.

It was at this period also, that Kepler first ventured upon the new method of representing inequalities which terminated in one of his most celebrated discoveries. We have already seen, in the account of the "Mysterium Cosmographicum," that he was speculating, even at that time, on the effects of a whirling force exerted by the sun on the planets with diminished energy at increased distances, and on the proportion observed between the distances of the planets from the sun, and their periods of revolution. He seems even then to have believed in the possibility of discovering a relation between the times and distances in different planets. Another analogous consequence of his theory of the radiation of the whirling force would be, that if the same planet should recede to a greater distance from the central body, it would be acted on by a diminished energy of revolution, and consequently, a relation might be found between the velocity at any point of its orbit, and its distance at that point from the sun. Hence he expected to derive a more direct and natural method of calculating the inequalities, than from the imaginary equant. But these ingenious ideas had been checked in the outset by the erroneous belief which Kepler, in common with other astronomers, then entertained of the coincidence of the earth's equant with its orbit; in other words, by the belief that the earth's linear motion was uniform, though it was known not to remain constantly at the same distance from the sun. As soon as this prejudice was removed, his former ideas recurred to him with increased force, and he set himself diligently to consider what relation could be found between the velocity and distance of a planet from the sun. The method he adopted in the beginning of this inquiry was to assume as approximately correct Ptolemy's doctrine of the bisection of the excentricity, and to investigate some simple relation nearly representing the same effect.

In the annexed figure, S is the place of the sun, C the centre of the planet's




orbit A B $a$ $b$, Q the centre of the equant represented by the equal circle D E $d$ $e$, A B, $a$ $b$, two equal small arcs described by the planet at the apsides of its orbit: then, according to Ptolemy's principles, the arc D E of the equant would be proportional to the time of passing along A B, on the same scale on which $d$ $e$ would represent the time of passing through the equal arc $a$ $b$.

Q D : Q A : : D E : A B, nearly; and because Q S is bisected in C, Q A, CA or Q D, and S A, are in arithmetical proportion: and, therefore, since an arithmetical mean, when the difference is small, does not differ much from a geometrical mean, Q D : Q A : : S A : Q D, nearly. Therefore, D E : A B : : S A : Q D, nearly, and in the same manner $d$ $e$ : $a$ $b$ : : S $a$ : Q $d$ nearly; and therefore D E : $d$ $e$ : : S A : S $a$ nearly. Therefore at the apsides, the times of passing over equal spaces, on Ptolemy's theory, are nearly as the distances from the sun, and Kepler, with his usual hastiness, immediately concluded that this was the accurate and general law, and that the errors of the old theory arose solely from having departed from it.

It followed immediately from this assumption, that after leaving the point A, the time in which the planet would

arrive at any point P of its orbit would be proportional to, and might be represented by, the sums of all the lines that could be drawn from S to the arc A P, on the same scale that the whole period of revolution would be denoted by the sum of all the lines drawn to every point of the orbit. Kepler's first attempt to verify this supposition approximately, was made by dividing the whole circumference of the orbit into 360 equal parts, and calculating the distances at every one of the points of division. Then supposing the planet to move uniformly, and to remain at the same distance from the sun during the time of passing each one of these divisions, (a supposition which manifestly would not differ much from the former one, and would coincide with it more nearly, the greater was the number of divisions taken) he proceeded to add together these calculated distances, and hoped to find that the time of arriving at any one of the divisions bore the same ratio to the whole period, as the sum of the corresponding set of distances did to the sum of the whole 360.

This theory was erroneous; but by almost miraculous good fortune, he was led by it in the following manner to the true measure. The discovery was a consequence of the tediousness of his first method, which required, in order to know the time of arriving at any point, that the circle should be subdivided, until one of the points of division fell exactly upon the given place. Kepler therefore endeavoured to discover some shorter method of representing these sums of the distances. The idea then occurred to him of employing for that purpose the area inclosed between the two distances, S A, S P, and the arc A P, in imitation of the manner in which he remembered that Archimedes had found the area of the circle, by dividing it into an infinite number of small triangles by lines drawn from the centre. He hoped therefore to find, that the time of passing from A to P bore nearly the same ratio to the whole period of revolution that the area A S P bore to the whole circle.

This last proportion is in fact accurately observed in the revolution of one body round another, in consequence of an attractive force in the central body. Newton afterwards proved this, grounding his demonstration upon laws of motion altogether irreconcileable with Kepler's opinions; and it is impossible not to admire Kepler's singular good fortune in arriving at this correct result in spite, or rather through the means, of his erroneous principles. It is true that the labour which he bestowed unsparingly upon every one of his successive guesses, joined with his admirable candour, generally preserved him from long retaining a theory altogether at variance with observations; and if any relation subsisted between the times and distances which could any way be expressed by any of the geometrical quantities under consideration, he could scarcely have failed—it might be twenty years earlier or twenty years later,—to light upon it at last, having once put his indefatigable fancy upon this scent. But in order to prevent an over-estimate of his merit in detecting this beautiful law of nature, let us for a moment reflect what might have been his fate had he endeavoured in the same manner, and with the same perseverance, to discover a relation, where, in reality, none existed. Let us take for example the inclinations or the excentricities of the planetary orbits, among which no relation has yet been discovered; and if any exists, it is probably of too complicated a nature to be hit at a venture. If Kepler had exerted his ingenuity in this direction, he might have wasted his life in fruitless labour, and whatever reputation he might have left behind him as an industrious calculator, it would have been very far inferior to that which has procured for him the proud title of the "Legislator of the Heavens."

However this may be, the immediate consequence of thus lighting upon the real law observed by the earth in its passage round the sun was, that he found himself in possession of a much more accurate method of representing its inequalities than had been reached by any of his predecessors; and with renewed hopes he again attacked the planet Mars, whose path he was now able to consider undistorted by the illusions arising out of the motion of the earth. Had the path of Mars been accurately circular, or even as nearly approaching a circle as that of the earth, the method he chose of determining its position and size by means of three distances carefully calculated from his observed parallaxes, would have given a satisfactory result; but finding, as he soon did, that almost every set of three distances led him to a different result, he began to suspect another error in the long-received opi-

nion, that the orbits of the planets must consist of a combination of circles; he therefore determined, in the first instance, to fix the distances of the planet at the apsides without any reference to the form of the intermediate orbit. Half the difference between these would, of course, be the excentricity of the orbit; and as this quantity came out very nearly the same as had been determined on the vicarious theory, it seemed clear that the error of that theory, whatever it might be, did not lie in these elements.

Kepler also found that in the case of this planet likewise, the times of describing equal arcs at the apsides were proportional to its distances from the sun, and he naturally expected that the method of areas would measure the planet's motion with as much accuracy as he had found in the case of the earth. This hope was disappointed: when he calculated the motion of the planet by this method, he obtained places too much advanced when near the apsides, and too little advanced at the mean distances. He did not, on that account, immediately reject the opinion of circular orbits, but was rather inclined to suspect the principle of measurement, at which he felt that he had arrived in rather a precarious manner. He was fully sensible that his areas did not accurately represent the sums of any distances except those measured from the centre of the circle; and for some time he abandoned the hope of being able to use this substitution, which he always considered merely as an approximate representation of the true measure, the sum of the distances. But on examination he found that the errors of this substitution were nearly insensible, and those it did in fact produce, were in the contrary direction of the errors he was at this time combating. As soon as he had satisfied himself of this, he ventured once more on the supposition, which by this time had, in his eyes, almost acquired the force of demonstration, that the orbits of the planets are not circular, but of an oval form, retiring within the circle at the mean distances, and coinciding with it at the apsides.

This notion was not altogether new; it had been suggested in the case of Mercury, by Purbach, in his "Theories of the Planets." In the edition of this work published by Reinhold, the pupil of Copernicus, we read the following passage. "Sixthly, it appears from what has been said, that the centre of Mercury's epicycle, by reason of the motions above-mentioned, does not, as is the case with the other planets, describe the circumference of a circular deferent, but rather the periphery of a figure resembling a plane oval." To this is added the following note by Reinhold. "The centre of the Moon's epicycle describes a path of a lenticular shape; Mercury's on the contrary is egg-shaped, the big end lying towards his apogee, and the little end towards his perigee*." The excentricity of Mercury's orbit is, in fact, much greater than that of any of the other planets, and the merit of making this first step cannot reasonably be withheld from Purbach and his commentator, although they did not pursue the inquiry so far as Kepler found himself in a condition to do.

Before proceeding to the consideration of the particular oval which Kepler fixed upon in the first instance, it will be necessary, in order to render intelligible the source of many of his doubts and difficulties, to make known something more of his theory of the moving force by which he supposed the planets to be carried round in their orbits. In conformity with the plan hitherto pursued, this shall be done as much as possible in his own words.

"It is one of the commonest axioms in natural philosophy, that if two things always happen together and in the same manner, and admit the same measure, either the one is the cause of the other, or both are the effect of a common cause. In the present case, the increase or languor of motion invariably corresponds with an approach to or departure from the centre of the universe. Therefore, either the languor is the cause of the departure of the star, or the departure of the languor, or both have a common cause. But no one can be of opinion that there is a concurrence of any third thing to be a common cause of these two effects, and in the following chapters it will be made clear that there is no occasion to imagine any such third thing, since the two are of themselves sufficient. Now, it is not agreeable to the nature of things that activity or languor in linear motion should be the cause of distance from the centre. For, distance from the centre is conceived anteriorly to linear motion. In fact linear motion cannot exist without dis-

* Theoricæ novæ planetarum. G. Purbachii, Parisiis, 1553.

tance from the centre, since it requires space for its accomplishment, but distance from the centre can be conceived without motion. Therefore distance is the cause of the activity of motion, and a greater or less distance of a greater or less delay. And since distance is of the kind of relative quantities, whose essence consists in boundaries, (for there is no efficacy in relation *per se* without regard to bounds,) it follows that the cause of the varying activity of motion rests in one of the boundaries. But the body of the planet neither becomes heavier by receding, nor lighter by approaching. Besides, it would perhaps be absurd on the very mention of it, that an animal force residing in the moveable body of the planet for the purpose of moving it, should exert and relax itself so often without weariness or decay. It remains, therefore, that the cause of this activity and languor resides at the other boundary, that is, in the very centre of the world, from which the distances are computed.—Let us continue our investigation of this moving virtue which resides in the sun, and we shall presently recognize its very close analogy to light. And although this moving virtue cannot be identical with the light of the sun, let others look to it whether the light is employed as a sort of instrument, or vehicle, to convey the moving virtue. There are these seeming contradictions:—first, light is obstructed by opaque bodies, for which reason if the moving virtue travelled on the light, darkness would be followed by a stoppage of the moveable bodies. Again, light flows out in right lines spherically, the moving virtue in right lines also, but cylindrically; that is, it turns in one direction only, from west to east; not in the opposite direction, not towards the poles, &c. But perhaps we shall be able presently to reply to these objections. In conclusion, since there is as much virtue in a large and remote circle as in a narrow and close one, nothing of the virtue perishes in the passage from its source, nothing is scattered between the source and the moveable. Therefore the efflux, like that of light, is not material, and is unlike that of odours, which are accompanied by a loss of substance, unlike heat from a raging furnace, unlike every other emanation by which mediums are filled. It remains, therefore, that as light which illuminates all earthly things, is the immaterial species of that fire which is in the body of the sun, so this virtue, embracing and moving all the planetary bodies, is the immaterial species of that virtue which resides in the sun itself, of incalculable energy, and so the primary act of all mundane motion.—I should like to know who ever said that there was anything material in light!—Guided by our notion of the efflux of this species (or archetype), let us contemplate the more intimate nature of the source itself. For it seems as if something divine were latent in the body of the sun, and comparable to our own soul, whence that species emanates which drives round the planets; just as from the mind of a slinger the species of motion sticks to the stones, and carries them forward, even after he who cast them has drawn back his hand. But to those who wish to proceed soberly, reflections differing a little from these will be offered."

Our readers will, perhaps, be satisfied with the assurance, that these sober considerations will not enable them to form a much more accurate notion of Kepler's meaning than the passages already cited. We shall therefore proceed to the various opinions he entertained on the motion of the planets.

He considered it as established by his theory, that the centre E of the planet's epicycle, (see fig. p. 33.) moved round the circumference of the deferent D*d*, according to the law of the planet's distances; the point remaining to be settled was the motion of the planet in the epicycle. If it were made to move according to the same law, so that when the centre of the epicycle reached E, the planet should be at F, taking the angle BEF equal to BSA, it has been shewn (p. 19) that the path of F would still be a circle, excentric from D*d* by DA the radius of the epicycle.

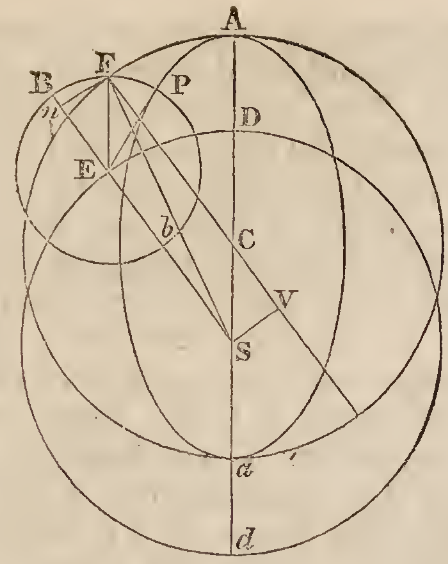
But Kepler fancied that he saw many sound reasons why this could not be the true law of motion in the epicycle, on which reasons he relied much more firmly than on the indisputable fact, which he mentions as a collateral proof, that it was contradicted by the observations. Some of these reasons are subjoined: "In the beginning of the work it has been declared to be most absurd, that a planet (even though we suppose it endowed with mind) should form any notion of a centre, and a distance from it, if there be no body in that centre to serve for a distinguishing mark. And although you should say, that the planet

has respect to the sun, and knows beforehand, and remembers the order in which the distances from the sun are comprised, so as to make a perfect excentric; in the first place, this is rather far-fetched, and requires, in any mind, means for connecting the effect of an accurately circular path with the sign of an increasing and diminishing diameter of the sun. But there are no such means, except the position of the centre of the excentric at a given distance from the sun; and I have already said, that this is beyond the power of a mere mind. I do not deny that a centre may be imagined, and a circle round it; but this I do say, if the circle exists only in imagination, with no external sign or division, that it is not possible that the path of a moveable body should be really ordered round it in an exact circle. Besides, if the planet chooses from memory its just distances from the sun, so as exactly to form a circle, it must also take from the same source, as if out of the Prussian or Alphonsine tables, equal excentric arcs, to be described in unequal times, and to be described by a force extraneous from the sun; and thus would have, from its memory, a foreknowledge of what effects a virtue, senseless and extraneous from the sun, was about to produce: all these consequences are absurd."

"It is therefore more agreeable to reason that the planet takes no thought, either of the excentric or epicycle; but that the work which it accomplishes, or joins in effecting, is a libratory path in the diameter B *b* of the epicycle, in the direction towards the sun. The law is now to be discovered, according to which the planet arrives at the proper distances in any time. And indeed in this inquiry, it is easier to say what the law is not than what it is."—Here, according to his custom, Kepler enumerates several laws of motion by which the planet might choose to regulate its energies, each of which is successively condemned. Only one of them is here mentioned, as a specimen of the rest. "What then if we were to say this? Although the motions of the planet are not epicyclical, perhaps the libration is so arranged that the distances from the sun are equal to what they would have been in a real epicyclical motion.—This leads to more incredible consequences than the former suppositions, and yet in the dearth of better opinions, let us for the present content ourselves with this. The greater number of absurd conclusions it will be found to involve, the more ready will a physician be, when we come to the fifty-second chapter, to admit what the observations testify, that the path of the planet is not circular."

The first oval path on which Kepler was induced to fix, by these and many other similar considerations, was in the first instance very different from the true elliptical form. Most authors would have thought it unnecessary to detain their readers with a theory which they had once entertained and rejected; but Kepler's work was written on a different plan. He thus introduces an explanation of his first oval. "As soon as I was thus taught by Brahe's very accurate observations that the orbit of a planet is not circular, but more compressed at the sides, on the instant I thought that I understood the natural cause of this deflection. But the old proverb was verified in my case;—the more haste the less speed.—For having violently laboured in the 39th chapter, in consequence of my inability to find a sufficiently probable cause why the orbit of the planet should be a perfect circle, (some absurdities always remaining with respect to that virtue which resides in the body of the planet,) and having now discovered from the observations, that the orbit is not a perfect circle, I felt furiously inclined to believe that if the theory which had been recognized as absurd, when employed in the 39th chapter for the purpose of fabricating a circle, were modulated into a more probable form, it would produce an accurate orbit agreeing with the observations. If I had entered on this course a little more warily, I might have detected the truth immediately. But, being blinded by my eagerness, and not sufficiently regardful of every part of the 39th chapter, and clinging to my first opinion, which offered itself to me with a wonderful show of probability, on account of the equable motion in the epicycle, I got entangled in new perplexities, with which we shall now have to struggle in this 45th chapter and the following ones as far as the 50th chapter."

In this theory, Kepler supposed that whilst the centre of the epicycle was moving round a circular deferent according to the law of the planets' distances (or areas) the planet itself moved equably in the epicycle, with the mean angular velocity of its centre in the deferent. In consequence of this supposition, since




at D, when the planet is at A the aphelion, the motion in the deferent is less than the mean motion, the planet will have advanced through an angle B E P greater than B E F or B S A, through which the centre of the epicycle has moved; and consequently, the path will lie everywhere within the circle A *a*, except at the apsides. Here was a new train of laborious calculations to undergo for the purpose of drawing the curve A P *a* according to this law, and of measuring the area of any part of it. After a variety of fruitless attempts, for this curve is one of singular complexity, he was reduced, as a last resource, to suppose it insensibly different from an ellipse on the same principal axes, as an approximate means of estimating its area. Not content even with the results so obtained, and not being able to see very clearly what might be the effect of his alteration in substituting the ellipse for the oval, and in other simplifications introduced by him, he had courage enough to obtain the sums of the 360 distances by direct calculation, as he had done in the old circular theory.

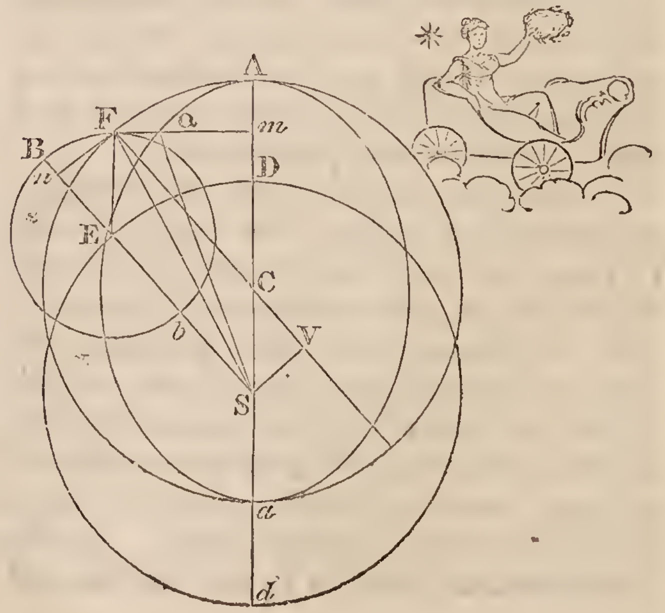
In the preface to his book he had spoken of his labours under the allegory of a war carried on by him against the planet; and when exulting in the early prospects of success this calculation seemed to offer, he did not omit once more to warn his readers, in his peculiar strain, that this exultation was premature.

"Allow me, gentle reader, to enjoy so splendid a triumph for one little day (I mean through the five next chapters), meantime be all rumours suppressed of new rebellion, that our preparations may not perish, yielding us no delight. Hereafter if anything shall come to pass, we will go through it in its own time and season; now let us be merry, as then we will be bold and vigorous." At the time foretold, that is to say, at the end of the five merry chapters, the bad news could no longer be kept a secret. It is announced in the following bulletin:—"While thus triumphing over Mars, and preparing for him, as for one altogether vanquished, tabular prisons, and equated eccentric fetters, it is buzzed here and there that the victory is vain, and that the war is raging anew as violently as before. For the enemy, left at home a despised captive, has burst all the chains of the equations, and broken forth of the prisons of the tables. For no method of geometrically administering the theory of the 45th chapter was able to come near the accuracy of approximation of the vicarious theory of the 16th chapter, which gave me true equations derived from false principles. Skirmishers, disposed all round the circuit of the excentric, (I mean the true distances,) routed my forces of physical causes levied out of the 45th chapter, and shaking off the yoke, regained their liberty. And now there was little to prevent the fugitive enemy from effecting a junction with his rebellious supporters, and reducing me to despair, had I not suddenly sent into the field a reserve of new physical reasonings on the rout and dispersion of the veterans, and diligently followed, without allowing him the slightest respite, in the direction in which he had broken out."

In plainer terms, Kepler found, after this labour was completed, that the errors in longitude he was still subject to were precisely of an opposite nature to those he had found with the circle; instead of being too quick at the apsides, the planet was now too slow there, and too much accelerated in the mean distances; and the distances obtained from direct observation were everywhere greater, except at the apsides, than those furnished by this oval theory. It was in the course of these tedious investigations that he established, still more satisfactorily than he had before done, that the inclinations of the planets' orbits are invariable, and that the lines of their nodes pass through the centre of the Sun, and not, as before his time had been supposed, through the centre of the ecliptic.

When Kepler found with certainty that this oval from which he expected so much would not satisfy the observations, his vexation was extreme, not merely from the mortification of finding a theory confuted on which he had spent

such excessive labour, for he was accustomed to disappointments of that kind, but principally from many anxious and fruitless speculations as to the real physical causes why the planet did not move in the supposed epicycle, that being the point of view, as has been already shewn, from which he always preferred to begin his inquiries. One part of the reasoning by which he reconciled himself to the failure exhibits much too curious a view of the state of his mind to be passed over in silence. The argument is founded on the difficulty which he met with, as abovementioned, in calculating the proportions of the oval path he had imagined. "In order that you may see the cause of the impracticability of this method which we have just gone through, consider on what foundations it rests. The planet is supposed to move equably in the epicycle, and to be carried by the Sun unequably in the proportion of the distances. But by this method it is impossible to be known how much of the oval path corresponds to any given time, although the distance at that part is known, unless we first know the length of the whole oval. But the length of the oval cannot be known, except from the law of the entry of the planet within the sides of the circle. But neither can the law of this entry be known before we know how much of the oval path corresponds to any given time. Here you see that there is a *petitio principii;* and in my operations I was assuming that of which I was in search, namely, the length of the oval. This is at least not the fault of my understanding, but it is also most alien to the primary Ordainer of the planetary courses: I have never yet found so ungeometrical a contrivance in his other works. Therefore we must either hit upon some other method of reducing the theory of the 45th chapter to calculation; or if that cannot be done, the theory itself, suspected on account of this *petitio principii*, will totter." Whilst his mind was thus occupied, one of those extraordinary accidents which it has been said never occur but to those capable of deriving advantage from them (but which, in fact, are never noticed when they occur to any one else), fortunately put him once more upon the right path. Half the extreme breadth between the oval and the circle nearly represented the errors of his distances at the mean point, and he found that this half was 429 parts of a radius, consisting of 100000 parts; and happening to advert to the greatest optical inequality of Mars, which amounts to about 5° 18′, it struck him that 429 was precisely the excess of the secant of 5° 18′ above the radius taken at 100000. This was a ray of light, and, to use his own words, it roused him as out of sleep. In short, this single observation was enough to produce conviction in his singularly constituted mind, that instead of the distances S F, he should everywhere substitute F V, determined by drawing S V perpendicular on the line F C, since the excess of S F above F V is manifestly that of the secant above the radius in the optical equation S F C at that point. It is still more extraordinary that a substitution made for such a reason should have the luck, as is again the case, to be the right one. This substitution in fact amounted to supposing that the planet, instead of being at the distance S P or S F, was at S $n$; or, in other words, that instead of revolving in the circumference, it librated in the diameter of the epicycle, which was to him an additional recommendation. Upon this new supposition a fresh set of distances was rapidly calculated, and to Kepler's inexpressible joy, they were found to agree with the observations within the limits of the errors to which the latter were necessarily subject. Notwithstanding this success, he had to undergo, before arriving at the successful termination of his labours, one more disappointment. Although the distance corresponding to a time from the aphelion represented approximately by the area A S F, was thus found to be accurately represented by the line S $n$, there was still an error with regard to the direction in which that distance was to be measured. Kepler's first idea was to set it off in the direction S F, but this he found to lead to inaccurate longitudes;



and it was not until after much perplexity, driving him, as he tells us, "almost to insanity," that he satisfied himself that the distance S Q equal to F V ought to be taken terminating in F $m$, the line from F perpendicular to A $a$, the line of apsides, and that the curve so traced out by Q would be an accurate ellipse.

He then found to his equal gratification and amazement, a small part of which he endeavoured to express by a triumphant figure on the side of his diagram, that the error he had committed in taking the area A S F to represent the sums of the distances S F, was exactly counterbalanced; for this area does accurately represent the sums of the distances F V or S Q. This compensation, which seemed to Kepler the greatest confirmation of his theory, is altogether accidental and immaterial, resulting from the relation between the ellipse and circle. If the laws of planetary attraction had chanced to have been any other than those which cause them to describe ellipses, this last singular confirmation of an erroneous theory could not have taken place, and Kepler would have been forced either to abandon the theory of the areas, which even then would have continued to measure and define their motions, or to renounce the physical opinions from which he professed to have deduced it as an approximative truth.

These are two of the three celebrated theorems called Kepler's laws: the first is, that the planets move in ellipses round the sun, placed in the focus; the second, that the time of describing any arc is proportional in the same orbit to the area included between the arc and the two bounding distances from the sun. The third will be mentioned on another occasion, as it was not discovered till twelve years later. On the establishment of these two theorems, it became important to discover a method of measuring such elliptic areas, but this is a problem which cannot be accurately solved. Kepler, in offering it to the attention of geometricians, stated his belief that its solution was unattainable by direct processes, on account of the incommensurability of the arc and sine, on which the measurement of the two parts A Q $m$, S Q $m$ depends. "This," says he in conclusion, "this is my belief, and whoever shall shew my mistake, and point out the true solution,

*Is erit mihi magnus Apollonius.*"

## Chapter VI.

*Kepler appointed Professor at Linz—His second marriage—Publishes his new Method of Gauging—Refuses a Professorship at Bologna.*

When presenting this celebrated book to the emperor, Kepler gave notice that he contemplated a farther attack upon Mars's relations, father Jupiter, brother Mercury, and the rest; and promised that he would be successful, provided the emperor would not forget the sinews of war, and order him to be furnished anew with means for recruiting his army. The death of his unhappy patron, the Emperor Rodolph, which happened in 1612, barely in time to save him from the last disgrace of deposition from the Imperial throne, seemed to put additional difficulties in the way of Kepler's receiving the arrears so unjustly denied to him; but on the accession of Rodolph's brother, Matthias, he was again named to his post of Imperial Mathematician, and had also a permanent professorship assigned to him in the University of Linz. He quitted Prague without much regret, where he had struggled against poverty during eleven years. Whatever disinclination he might feel to depart, arose from his unwillingness to loosen still more the hold he yet retained upon the wreck of Tycho Brahe's instruments and observations. Tengnagel, son-in-law of Tycho, had abandoned astronomy for a political career, and the other members of his family, who were principally females, suffered the costly instruments to lie neglected and forgotten, although they had obstructed with the utmost jealousy Kepler's attempts to continue their utility. The only two instruments Kepler possessed of his own property, were "An iron sextant of $2\frac{1}{2}$ feet diameter, and a brass azimuthal quadrant, of $3\frac{1}{2}$ feet diameter, both divided into minutes of a degree." These were the gift of his friend and patron, Hoffman, the President of Styria, and with these he made all the observations which he added to those of Tycho Brahe. His constitution was not favourable to these studies, his health being always delicate, and suffering much from exposure to the night air; his eyes also were very weak, as he mentions himself in several places. In the summary of his character which he drew up when proposing to become Tycho Brahe's assistant, he describes himself as follows:—"For observations

my sight is dull; for mechanical operations my hand is awkward; in politics and domestic matters my nature is troublesome and choleric; my constitution will not allow me, even when in good health, to remain a long time sedentary (particularly for an extraordinary time after dinner); I must rise often and walk about, and in different seasons am forced to make corresponding changes in my diet."

The year preceding his departure to Linz was denounced by him as pregnant with misfortune and misery. "In the first place I could get no money from the court, and my wife, who had for a long time been suffering under low spirits and despondency, was taken violently ill towards the end of 1610, with the Hungarian fever, epilepsy, and phrenitis. She was scarcely convalescent when all my three children were at once attacked with small-pox. Leopold with his army occupied the town beyond the river, just as I lost the dearest of my sons, him whose nativity you will find in my book on the new star. The town on this side of the river where I lived was harassed by the Bohemian troops, whose new levies were insubordinate and insolent: to complete the whole, the Austrian army brought the plague with them into the city. I went into Austria, and endeavoured to procure the situation which I now hold. Returning in June, I found my wife in a decline from her grief at the death of her son; and on the eve of an infectious fever; and I lost her also, within eleven days after my return. Then came fresh annoyance, of course, and her fortune was to be divided with my step-sisters. The Emperor Rodolph would not agree to my departure; vain hopes were given me of being paid from Saxony; my time and money were wasted together, till on the death of the emperor, in 1612, I was named again by his successor, and suffered to depart to Linz. These, methinks, were reasons enough why I should have overlooked not only your letters, but even astronomy itself."

Kepler's first marriage had not been a happy one; but the necessity in which he felt himself of providing some one to take charge of his two surviving children, of whom the eldest, Susanna, was born in 1602, and Louis in 1607, determined him on entering a second time into the married state. The account he has left us of the various negotiations which preceded his final choice, does not, in any point, belie the oddity of his character. His friends seem to have received a general commission to look out for a suitable match, and in a long and most amusing letter to the Baron Strahlendorf, we are made acquainted with the pretensions and qualifications of no less than eleven ladies among whom his inclinations wavered.

The first on the list was a widow, an intimate friend of his first wife's, and who, on many accounts, appeared a most eligible match. "At first she seemed favourably inclined to the proposal; it is certain that she took time to consider it, but at last she very quietly excused herself." It must have been from a recollection of this lady's good qualities that Kepler was induced to make his offer; for we learn rather unexpectedly, after being informed of her decision, that when he soon afterwards paid his respects to her, it was for the first time that he had seen her during the last six years; and he found, to his great relief, that "there was no single pleasing point about her." The truth seems to be that he was nettled by her answer, and he is at greater pains than appear necessary, considering this last discovery, to determine why she would not accept his offered hand. Among other reasons he suggested her children, among whom were two marriageable daughters; and it is diverting afterwards to find them also in the catalogue which Kepler appeared to be making of all his female acquaintance. He seems to have been much perplexed in attempting to reconcile his astrological theory with the fact of his having taken so much trouble about a negotiation not destined to succeed. "Have the stars exercised any influence here? For just about this time the direction of the Mid-Heaven is in hot opposition to Mars, and the passage of Saturn, through the ascending point of the zodiac, in the scheme of my nativity, will happen again next November and December. But if these are the causes, how do they act? Is that explanation the true one which I have elsewhere given? For I can never think of handing over to the stars the office of deities to produce effects. Let us therefore suppose it accounted for by the stars, that at this season I am violent in my temper and affections, in rashness of belief, in a shew of pitiful tenderheartedness; in catching at reputation by new and paradoxical notions, and the

singularity of my actions; in busily inquiring into, and weighing and discussing, various reasons; in the uneasiness of my mind with respect to my choice. I thank God that that did not happen which might have happened; that this marriage did not take place: now for the others." Of these others, one was too old, another in bad health, another too proud of her birth and quarterings; a fourth had learned nothing but shewy accomplishments, "not at all suitable to the sort of life she would have to lead with me." Another grew impatient, and married a more decided admirer, whilst he was hesitating. "The mischief (says he) in all these attachments was, that whilst I was delaying, comparing, and balancing conflicting reasons, every day saw me inflamed with a new passion." By the time he reached the eighth, he found his match in this respect. "Fortune at length has avenged herself on my doubtful inclinations. At first she was quite complying, and her friends also: presently, whether she did or did not consent, not only I, but she herself did not know. After the lapse of a few days, came a renewed promise, which however had to be confirmed a third time; and four days after that, she again repented her confirmation, and begged to be excused from it. Upon this I gave her up, and this time all my counsellors were of one opinion." This was the longest courtship in the list, having lasted three whole months; and quite disheartened by its bad success, Kepler's next attempt was of a more timid complexion. His advances to No. 9, were made by confiding to her the whole story of his recent disappointment, prudently determining to be guided in his behaviour, by observing whether the treatment he had experienced met with a proper degree of sympathy. Apparently the experiment did not succeed; and almost reduced to despair, Kepler betook himself to the advice of a friend, who had for some time past complained that she was not consulted in this difficult negotiation. When she produced No. 10, and the first visit was paid, the report upon her was as follows:—"She has, undoubtedly, a good fortune, is of good family, and of economical habits: but her physiognomy is most horribly ugly; she would be stared at in the streets, not to mention the striking disproportion in our figures. I am lank, lean, and spare; she is short and thick: in a family notorious for fatness she is considered superfluously fat." The only objection to No. 11 seems to have been her excessive youth; and when this treaty was broken of on that account, Kepler turned his back upon all his advisers, and chose for himself one who had figured as No. 5 in the list, to whom he professes to have felt attached throughout, but from whom the representations of his friends had hitherto detained him, probably on account of her humble station.

The following is Kepler's summary of her character. "Her name is Susanna, the daughter of John Reuthinger and Barbara, citizens of the town of Eferdingen; the father was by trade a cabinet-maker, but both her parents are dead. She has received an education well worth the largest dowry, by favour of the Lady of Stahrenberg, the strictness of whose household is famous throughout the province. Her person and manners are suitable to mine; no pride, no extravagance; she can bear to work; she has a tolerable knowledge how to manage a family; middle-aged, and of a disposition and capability to acquire what she still wants. Her I shall marry by favour of the noble baron of Stahrenberg at twelve o'clock on the 30th of next October, with all Eferdingen assembled to meet us, and we shall eat the marriage-dinner at Maurice's at the Golden Lion."

Hantsch has made an absurd mistake with regard to this marriage, in stating that the bride was only twelve years old. Kästner and other biographers have been content to repeat the same assertion without any comment, notwithstanding its evident improbability. The origin of the blunder is to be found in Kepler's correspondence with Bernegger, to whom, speaking of his wife, he says "She has been educated for twelve years by the Lady of Stahrenberg." This is by no means a single instance of carelessness in Hantsch; Kästner has pointed out others of greater consequence. It was owing to this marriage, that Kepler took occasion to write his new method of gauging, for as he tells us in his own peculiar style "last November I brought home a new wife, and as the whole course of Danube was then covered with the produce of the Austrian vineyards, to be sold at a reasonable rate, I purchased a few casks, thinking it my duty as a good husband and a father of a family, to see that my household was well provided with drink." When the seller came to ascertain the quantity, Kepler objected to his method

of gauging, for he allowed no difference, whatever might be the proportion of the bulging parts. The reflections to which this incident gave rise, terminated in the publication of the above-mentioned treatise, which claims a place among the earliest specimens of what is now called the modern analysis. In it he extended several properties of plane figures to segments of cones and cylinders, from the consideration that "these solids are incorporated circles," and, therefore, that those properties are true of the whole which belong to each component part. That the book might end as oddly as it began, Kepler concluded it with a parody of Catullus:

> "Et cum pocula mille mensi erîmus
> Conturbabimus illa, ne sciamus."

His new residence at Linz was not long undisturbed. He quarrelled there, as he had done in the early part of his life at Gratz, with the Roman Catholic party, and was excommunicated. "Judge," says he to Peter Hoffman, "how far I can assist you, in a place where the priest and school-inspector have combined to brand me with the public stigma of heresy, because in every question I take that side which seems to me to be consonant with the word of God." The particular dogma which occasioned his excommunication, was connected with the doctrine of transubstantiation. He published his creed in a copy of Latin verses, preserved by his biographer Hantsch.

Before this occurrence, Kepler had been called to the diet at Ratisbon to give his opinion on the propriety of adopting the Gregorian reformation of the calendar, and he published a short essay, pointing out the respective convenience of doing so, or of altering the old Julian Calendar in some other manner. Notwithstanding the readiness of the diet to avail themselves of his talents for the settlement of a difficult question, the arrears of his salary were not paid much more regularly than they had been in Rodolph's time, and he was driven to provide himself with money by the publication of his almanac, of which necessity he heavily and justly complained. "In order to pay the expense of the Ephemeris for these two years, I have also written a vile prophesying almanac, which is scarcely more respectable than begging; unless it be because it saves the emperor's credit, who abandons me entirely; and with all his frequent and recent orders in council, would suffer me to perish with hunger." Kepler published this Ephemeris annually till 1620; ten years later he added those belonging to the years from 1620 to 1628.

In 1617 Kepler was invited into Italy, to succeed Magini as Professor of Mathematics at Bologna. The offer tempted him; but, after mature consideration, he rejected it, on grounds which he thus explained to Roffini:—"By birth and spirit I am a German, imbued with German principles, and bound by such family ties, that even if the emperor should consent, I could not, without the greatest difficulty, remove my dwelling-place from Germany into Italy. And although the glory of holding so distinguished a situation among the venerable professors of Bologna stimulates me, and there appears great likelihood of notably increasing my fortune, as well from the great concourse to the public lectures, as from private tuition; yet, on the other hand, that period of my life is past which was once excited by novelty, or which might promise itself a long enjoyment of these advantages. Besides, from a boy up to my present years, living a German among Germans, I am accustomed to a degree of freedom in my speech and manners, which, if persevered in on my removal to Bologna, seems likely to draw upon me, if not danger, at least notoriety, and might expose me to suspicion and party malice. Notwithstanding this answer, I have yet hopes that your most honourable invitation will be of service to me, and may make the imperial treasurer more ready than he has hitherto been to fulfil his master's intentions towards me. In that case I shall the sooner be able to publish the Rudolphine Tables and the Ephemerides, of which you had the scheme so many years back; and in this manner you and your advisers may have no reason to regret this invitation, though for the present it seems fruitless."

In 1619, the Emperor Matthias died, and was succeeded by Ferdinand III., who retained Kepler in the post he had filled under his two predecessors on the imperial throne. Kästner, in his "History of Mathematics," has corrected a gross error of Hantsch, in asserting that Kepler prognosticated Matthias's death. The letter to which Hantsch refers, in support of his statement, does indeed mention the emperor's death, but merely as a notorious event, for the purpose of recalling a date to the memory of his correspondent.

how much Kepler did, and how much he did not believe on the subject of genethliac astrology.—“ Hence it is that human spirits, at the time of celestial aspects, are particularly urged to complete the matters which they have in hand. What the goad is to the ox, what the spur or the rowel is to the horse, to the soldier the bell and trumpet, an animated speech to an audience, to a crowd of rustics a performance on the fife and bagpipes, that to all, and especially in the aggregate, is a heavenly configuration of suitable planets; so that every single one is excited in his thoughts and actions, and all become more ready to unite and associate their efforts. For instance, in war you may see that tumults, battles, fights, invasions, assaults, attacks, and panic fears, generally happen at the time of the aspects of Mars and Mercury, Mars and Jupiter, Mars and the Sun, Mars and Saturn, &c. In epidemic diseases, a greater number of persons are attacked at the times of the powerful aspects, they suffer more severely, or even die, owing to the failure of nature in her strife with the disease, which strife (and not the death) is occasioned by the aspect. It is not the sky which does all these things immediately, but the faculty of the vital soul, associating its operation with the celestial harmonies, is the principal agent in this so-called influence of the heavens. Indeed this word influence has so fascinated some philosophers that they prefer raving with the senseless vulgar, to learning the truth with me. This essential property is the principal foundation of that admirable genethliac art. For when anything begins to have its being when that is working harmonies, the sensible harmony of the rays of the planets has peculiar influence on it. This then is the cause why those who are born under a season of many aspects among the planets, generally turn out busy and industrious, whether they accustom themselves from childhood to amass wealth, or are born or chosen to direct public affairs, or finally, have given their attention to study. If any one think that I might be taken as an instance of this last class, I do not grudge him the knowledge of my nativity. I am not checked by the reproach of boastfulness, notwithstanding those who, by speech or conduct, condemn as folly all kinds of writing on this subject; the idiots, the half-learned, the inventors of titles and trappings, to throw dust in the eyes of the people, and those whom Picus calls the plebeian theologians: among the true lovers of wisdom, I easily clear myself of this imputation, by the advantage of my reader; for there is no one whose nativity or whose internal disposition and temper I can learn so well as I know my own. Well then, Jupiter nearest the nonagesimal had passed by four degrees the trine of Saturn; the Sun and Venus, in conjunction, were moving from the latter towards the former, nearly in sextiles with both: they were also removing from quadratures with Mars, to which Mercury was closely approaching: the moon drew near the trine of the same planet, close to the Bull's Eye, even in latitude. The 25th degree of Gemini was rising, and the 22d of Aquarius culminating. That there was this triple configuration on that day—namely, the sextile of Saturn and the Sun, the sextile of Mars and Jupiter, the quadrature of Mercury and Mars, is proved by the change of weather; for, after a frost of some days, that very day became warmer, there was a thaw and a fall of rain.*”

“ I do not wish this single instance to be taken as a defence and proof of all the aphorisms of astrologers, nor do I attribute to the heavens the government of human affairs: what a vast interval still separates these philosophical observations from that folly or madness as it should rather be called. For, following up this example, I knew a lady†, born under nearly the same aspects, whose disposition, indeed, was exceedingly restless, but who not only makes no progress in literature (that is not strange in a woman), but troubles her whole family, and is the cause to herself of deplorable misery. What, in my case, assisted the aspects was—firstly, the fancy of my mother when pregnant with me, a great admirer of her mother-in-law, my grandmother, who had some knowledge of medicine, my grandfather's profession; a second cause is, that I

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* This mode of verifying configurations, though something of the boldest, was by no means unusual. On a former occasion Kepler, wishing to cast the nativity of his friend Zehentmaier, and being unable to procure more accurate information than that he was born about three o'clock in the afternoon of the 21st of October, 1751, supplied the deficiency by a record of fevers and accidents at known periods of his life, from which he deduced a more exact horoscope.

† Kepler probably meant his own mother, whose horoscope he in many places declared to be nearly the same as his own.

was born a male, and not a female, for astrologers have sought in vain to distinguish sexes in the sky; thirdly, I derive from my mother a habit of body, more fit for study than other kinds of life; fourthly, my parents' fortune was not large, and there was no landed property to which I might succeed and become attached; fifthly, there were the schools, and the liberality of the magistracy towards such boys as were apt for learning. But now if I am to speak of the result of my studies, what I pray can I find in the sky, even remotely alluding to it. The learned confess that several not despicable branches of philosophy have been newly extricated or amended or brought to perfection by me: but here my constellations were, not Mercury from the east, in the angle of the seventh, and in quadratures with Mars, but Copernicus, but Tycho Brahe, without whose books of observations everything now set by me in the clearest light must have remained buried in darkness; not Saturn predominating Mercury, but my Lords the Emperors Rodolph and Matthias; not Capricorn, the house of Saturn, but Upper Austria, the home of the Emperor, and the ready and unexampled bounty of his nobles to my petition. Here is that corner, not the western one of the horoscope, but on the Earth, whither, by permission of my imperial master, I have betaken myself from a too uneasy court; and whence, during these years of my life, which now tends towards its setting, emanate these Harmonies, and the other matters on which I am engaged."

"However, it may be owing to Jupiter's ascendancy that I take greater delight in the application of geometry to physics, than in that abstract pursuit which partakes of the dryness of Saturn; and it is perhaps the gibbous moon, in the bright constellation of the Bull's forehead, which fills my mind with fantastic images."

The most remarkable thing contained in the 5th Book, is the announcement of the celebrated law connecting the mean distances of the planets with the periods of their revolution about the Sun. This law is expressed in mathematical language, by saying that the squares of the times vary as the cubes of the distances*. Kepler's rapture on detecting it was unbounded, as may be seen from the exulting rhapsody with which he announced it. "What I prophecied two-and-twenty years ago, as soon as I discovered the five solids among the heavenly orbits — what I firmly believed long before I had seen Ptolemy's 'Harmonics'—what I had promised my friends in the title of this book, which I named before I was sure of my discovery—what, sixteen years ago, I urged as a thing to be sought—that for which I joined Tycho Brahe, for which I settled in Prague, for which I have devoted the best part of my life to astronomical contemplations, at length I have brought to light, and have recognized its truth beyond my most sanguine expectations. Great as is the absolute nature of Harmonics with all its details, as set forth in my third book, it is all found among the celestial motions, not indeed in the manner which I imagined, (that is not the least part of my delight,) but in another very different, and yet most perfect and excellent. It is now eighteen months since I got the first glimpse of light, three months since the dawn, very few days since the unveiled sun, most admirable to gaze on, burst out upon me. Nothing holds me; I will indulge in my sacred fury; I will triumph over mankind by the honest confession, that I have stolen the golden vases of the Egyptians*, to build up a tabernacle for my God far away from the confines of Egypt. If you forgive me, I rejoice; if you are angry, I can bear it: the die is cast, the book is written; to be read either now or by posterity, I care not which: it may well wait a century for a reader, as God has waited six thousand years for an observer."

He has told, with his usual particularity, the manner and precise moment of the discovery. "Another part of my 'Cosmographical Mystery,' suspended twenty-two years ago, because it was then undetermined, is completed and introduced here, after I had discovered the true intervals of the orbits, by means of Brahe's observations, and had spent the continuous toil of a long time in investigating the true proportion of the periodic times to the orbits,

> Sera quidem respexit inertem,
> Respexit tamen, et longo post tempore venit.

If you would know the precise moment, the first idea came across me on the 8th March of this year, 1618; but chancing

* See Preliminary Treatise, p. 13.

* In allusion to the Harmonics of Ptolemy.

to make a mistake in the calculation, I rejected it as false. I returned again to it with new force on the 15th May, and it has dissipated the darkness of my mind by such an agreement between this idea and my seventeen years' labour on Brahe's observations, that at first I thought I must be dreaming, and had taken my result for granted in my first assumptions. But the fact is perfect, the fact is certain, that the proportion existing between the periodic times of any two planets is exactly the sesquiplicate proportion of the mean distances of the orbits."

There is high authority for not attempting over anxiously to understand the rest of the work. Delambre sums it up as follows:—"In the music of the celestial bodies it appears that Saturn and Jupiter take the bass, Mars the tenor, the Earth and Venus the counter-tenor, and Mercury the treble." If the patience of this indefatigable historian gave way, as he confesses, in the perusal, any further notice of it here may be well excused. Kepler became engaged, in consequence of this publication, in an angry controversy with the eccentric Robert Fludd, who was at least Kepler's match in wild extravagance and mysticism, if far inferior to him in genius. It is diverting to hear each reproaching the other with obscurity.

In the "Epitome of the Copernican Astronomy," which Kepler published about the same time, we find the manner in which he endeavoured to deduce the beautiful law of periodic times, from his principles of motion and radiation of whirling forces. This work is in fact a summary of all his astronomical opinions, drawn up in a popular style in the form of question and answer. We find there a singular argument against believing, as some did, that each planet is carried round by an angel, for in that case, says Kepler, "the orbits would be perfectly circular; but the elliptic form, which we find in them, rather smacks of the nature of the lever and material necessity."

The investigation of the relation between the periodic times and distances of the planets is introduced by a query whether or not they are to be considered heavy. The answer is given in the following terms:—"Although none of the celestial globes are heavy, in the sense in which we say on earth that a stone is heavy, nor light as fire is light with us, yet have they, by reason of their materiality, a natural inability to move from place to place: they have a natural inertness or quietude, in consequence of which they remain still in every situation where they are placed alone."

"*P.* Is it then the sun, which by its turning carries round the planets? How can the sun do this, having no hands to seize the planet at so great a distance, and force it round along with itself?—Its bodily virtue, sent forth in straight lines into the whole space of the world, serves instead of hands; and this virtue, being a corporeal species, turns with the body of the sun like a very rapid vortex, and travels over the whole of that space which it fills as quickly as the sun revolves in its very confined space round the centre.

"*P.* Explain what this virtue is, and belonging to what class of things?—As there are two bodies, the mover and the moved, so are there two powers by which the motion is obtained. The one is passive, and rather belonging to matter, namely, the resemblance of the body of the planet to the body of the sun in its corporeal form, and so that part of the planetary body is friendly, the opposite part hostile to the sun. The other power is active, and bearing more relation to form, namely, the body of the sun has a power of attracting the planet by its friendly part, of repelling it by the hostile part, and finally, of retaining it if it be placed so that neither the one nor the other be turned directly towards the sun.

"*P.* How can it be that the whole body of the planet should be like or cognate to the body of the sun, and yet part of the planet friendly, part hostile to the sun? —Just as when one magnet attracts another, the bodies are cognate; but attraction takes place only on one side, repulsion on the other.

"*P.* Whence, then, arises that difference of opposite parts in the same body? —In magnets the diversity arises from the situation of the parts with respect to the whole. In the heavens the matter is a little differently arranged, for the sun does not, like the magnet, possess only on one side, but in all the parts of its substance, this active and energetic faculty of attracting, repelling, or retaining the planet. So that it is probable that the centre of the solar body corresponds to one extremity or pole of the magnet, and its whole surface to the other pole.

"*P.* If this were so, all the planets

would be restored* in the same time with the sun ?—True, if this were all: but it has been said already that, besides this carrying power of the sun, there is also in the planets a natural inertness to motion, which causes that, by reason of their material substance, they are inclined to remain each in its place. The carrying power of the sun, and the impotence or material inertness of the planet, are thus in opposition. Each shares the victory; the sun moves the planet from its place, although in some degree it escapes from the chains with which it was held by the sun, and so is taken hold of successively by every part of this circular virtue, or, as it may be called, solar circumference, namely, by the parts which follow those from which it has just extricated itself.

"*P.* But how does one planet extricate itself more than another from this violence—First, because the virtue emanating from the sun has the same degree of weakness at different distances, as the distances or the width of the circles described on these distances†. This is the principal reason. Secondly, the cause is partly in the greater or less inertness or resistance of the planetary globes, which reduces the proportions to one-half; but of this more hereafter.

"*P.* How can it be that the virtue emanating from the sun becomes weaker at a greater distance? What is there to hurt or weaken it?—Because that virtue is corporeal, and partaking of quantity, which can be spread out and rarefied. Then, since there is as much virtue diffused in the vast orb of Saturn as is collected in the very narrow one of Mercury, it is very rare and therefore weak in Saturn's orbit, very dense and therefore powerful at Mercury.

"*P.* You said, in the beginning of this inquiry into motion, that the periodic times of the planets are exactly in the sesquiplicate proportion of their orbits or circles: pray what is the cause of this? —Four causes concur for lengthening the periodic time. First, the length of the path; secondly, the weight or quantity of matter to be carried; thirdly, the degree of strength of the moving virtue; fourthly, the bulk or space into which is spread out the matter to be moved. The circular paths of the planets are in the simple ratio of the distances; the weights or quantities of matter in different planets are in the subduplicate ratio of the same distances, as has been already proved; so that with every increase of distance, a planet has more matter, and therefore is moved more slowly, and accumulates more time in its revolution, requiring already as it did more time by reason of the length of the way. The third and fourth causes compensate each other in a comparison of different planets: the simple and subduplicate proportion compound the sesquiplicate proportion, which therefore is the ratio of the periodic times."

Three of the four suppositions here made by Kepler to explain the beautiful law he had detected, are now indisputably known to be false. Neither the weights nor the sizes of the different planets observe the proportions assigned by him, nor is the force by which they are retained in their orbits in any respect similar in its effects to those attributed by him to it. The wonder which might naturally be felt that he should nevertheless reach the desired conclusion, will be considerably abated on examining the mode in which he arrived at and satisfied himself of the truth of these three suppositions. It has been already mentioned that his notions on the existence of a whirling force emanating from the sun, and decreasing in energy at increased distances, are altogether inconsistent with all the experiments and observations we are able to collect. His reason for asserting that the sizes of the different planets are proportional to their distances from the sun, was simply because he chose to take for granted that either their solidities, surfaces, or diameters, must necessarily be in that proportion, and of the three, the solidities appeared to him least liable to objection. The last element of his precarious reasoning rested upon equally groundless assumptions. Taking as a principle, that where there is a number of different things they must be different in every respect, he declared that it was quite unreasonable to suppose all the planets of the same density. He thought it indisputable that they must be rarer as they were farther from the sun, "and yet not in the proportion of their distances, for thus we should sin against the law of variety in another way, and make the quantity of matter (according to what he had just said of their bulk) the same in

* This is a word borrowed from the Ptolemaic astronomy, according to which the sun and planets are hurried from their places by the daily motion of the *primum mobile*, and by their own peculiar motion seek to regain or be restored to their former places.

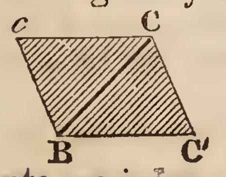
† In other parts of his works Kepler assumes the diminution to be proportional to the circles themselves, not to the diameters.

all. But if we assume the ratio of the quantities of matter to be half that of the distances, we shall observe the best mean of all; for thus Saturn will be half as heavy again as Jupiter, and Jupiter half again as dense as Saturn. And the strongest argument of all is, that unless we assume this proportion of the densities, the law of the periodic times will not answer." This is the *proof* alluded to, and it is clear that by such reasoning any required result might be deduced from any given principles.

It may not be uninstructive to subjoin a sketch of the manner in which Newton established the same celebrated results, starting from principles of motion diametrically opposed to Kepler's, and it need scarcely be added, reasoning upon them in a manner not less different. For this purpose, a very few prefatory remarks will be found sufficient.

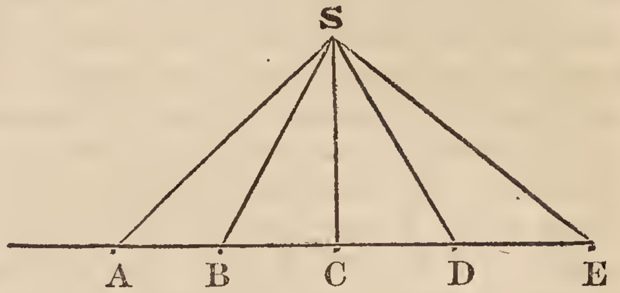
The different motions seen in nature are best analysed and classified by supposing that every body in motion, if left to itself, will continue to move forward at the same rate in a straight line, and by considering all the observed deviations from this manner of moving, as exceptions and disturbances occasioned by some external cause. To this supposed cause is generally given the name of Force, and it is said to be the first law of motion, that, unless acted on by some force, every body at rest remains at rest, and every body in motion proceeds uniformly in a straight line. Many employ this language, without perceiving that it involves a definition of force, on the admission of which, it is reduced to a truism. We see common instances of force in a blow, or a pull from the end of a string fastened to the body: we shall also have occasion presently to mention some forces where no visible connexion exists between the moving body and that towards which the motion takes place, and from which the force is said to proceed.

A second law of motion, founded upon experiment, is this: if a body have motion communicated to it in two directions, by one of which motions alone it would have passed through a given space in a given time, as for instance, through B C′ in one second, and by the other alone through any other space B $c$ in the same time, it will, when both are given to it at the same instant, pass in the same time (in the present instance in one second) through B C the



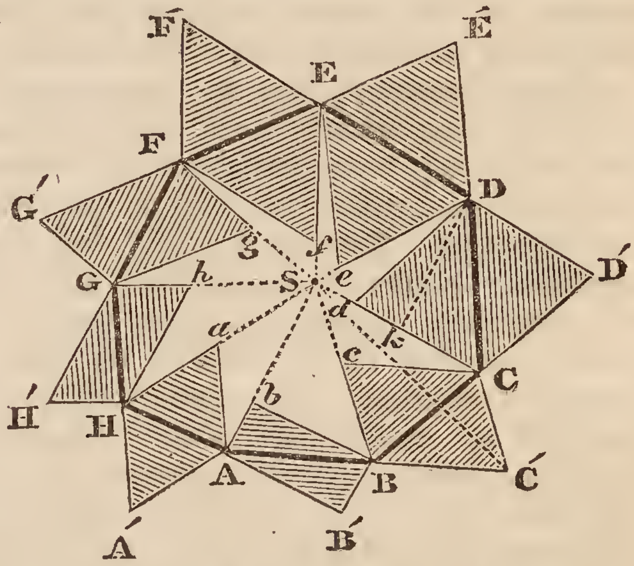

diagonal of the parallelogram of which B C′ and B $c$ are sides.

Let a body, acted upon by no force, be moving along the line A E; that




means, according to what has been said, let it pass over the equal straight lines A B, B C, C D, D E, &c., in equal times. If we take any point S not in the line A E, and join A S, B S, &c., the triangles A S B, B S C, &c. are also equal, having a common altitude and standing on equal bases, so that if a string were conceived reaching from S to the moving body (being lengthened or shortened in each position to suit its distance from S), this string, as the body moved along A E, would sweep over equal triangular areas in equal times.

Let us now examine how far these




conclusions will be altered if the body from time to time is forced towards S. We will suppose it moving uniformly from A to B as before, no matter for the present how it got to A, or into the direction A B. If left to itself it would, in an equal time (say 1″) go through B C′ in the same straight line with and equal to A B. But just as it reaches B, and is beginning to move along B C′, let it be suddenly pulled towards S with a motion which, had it been at rest, would have carried it in the same time, 1″, through any other space B $c$. According to the second law of motion, its direction during this 1″, in consequence of the two motions combined, will be along B C, the diagonal of the parallelogram of which B C′, B $c$, are sides. In

this case, as this figure is drawn, B C, though passed in the same time, is longer than A B; that is to say, the body is moving quicker than at first. How is it with the triangular areas, supposed as before to be swept by a string constantly stretched between S and the body? It will soon be seen that these still remain equal, notwithstanding the change of direction, and increased swiftness. For since C C′ is parallel to B *c*, the triangles S C B, S C′ B are equal, being on the same base S B, and between the same parallels S B, C C′, and S C′B is equal to S B A as before, therefore S C B, S B A are equal. The body is now moving uniformly (though quicker than along A B) along B C. As before, it would in a time equal to the time of passing along B C, go through an equal space C D′ in the same straight line. But if at C it has a second pull towards S, strong enough to carry it to *d* in the same time, its direction will change a second time to C D, the diagonal of the parallelogram, whose sides are C D′, C *d*; and the circumstances being exactly similar to those at the first pull, it is shewn in the same manner that the triangular area S D C = S C B = S B A.

Thus it appears, that in consequence of these intermitting pulls towards S, the body may be moving round, sometimes faster, sometimes slower, but that the triangles formed by any of the straight portions of its path (which are all described in equal times), and the lines joining S to the ends of that portion, are all equal. The path it will take depends of course, in other respects, upon the frequency and strength of the different pulls, and it might happen, if they were duly proportionate, that when at H, and moving off in the direction H A′, the pull H *a* might be such as just to carry the body back to A, the point from which it started, and with such a motion, that after one pull more, A *b*, at A, it might move along A B as it did at first. If this were so, the body would continue to move round in the same polygonal path, alternately approaching and receding from S, as long as the same pulls were repeated in the same order, and at the same intervals.

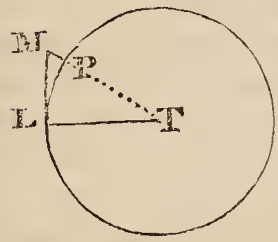
It seems almost unnecessary to remark, that the same equality which subsists between any two of these triangular areas subsists also between an equal number of them, from whatever part of the path taken; so that, for instance, the four paths A B, B C, C D, D E, corresponding to the four areas A S B, B S C, C S D, D S E, that is, to the area A B C D E S, are passed in the same time as the four E F, F G, G H, H A, corresponding to the equal area E F G H A S. Hence it may be seen, if the whole time of revolution from A round to A again be called a year, that in half a year the body will have got to E, which in the present figure is more than half way round, and so of any other periods.

The more frequently the pulls are supposed to recur, the more frequently will the body change its direction; and if the pull were supposed constantly exerted in the direction towards S, the body would move in a curve round S, for no three successive positions of it could be in a straight line. Those who are not familiar with the methods of measuring curvilinear spaces must here be contented to observe, that the law holds, however close the pulls are brought together, and however closely the polygon is consequently made to resemble a curve: they may, if they please, consider the minute portions into which the curve is so divided, as differing insensibly from little rectilinear triangles, any equal number of which, according to what has been said above, wherever taken in the curve, would be swept in equal times. The theorem admits, in this case also, a rigorous proof; but it is not easy to make it entirely satisfactory, without entering into explanations which would detain us too long from our principal subject.

The proportion in which the pull is strong or weak at different distances from the central spot, is called "*the law of the central or centripetal force*," and it may be observed, that after assuming the laws of motion, our investigations cease to have anything hypothetical or experimental in them; and that if we wish, according to these principles of motion, to determine the law of force necessary to make a body move in a curve of any required form, or conversely to discover the form of the curve described, in consequence of any assumed law of force, the inquiry is purely geometrical, depending upon the nature and properties of geometrical quantities only. This distinction between what is hypothetical, and what necessary truth, ought never to be lost sight of.

As the object of the present treatise is not to teach geometry, we shall de-

scribe, in very general terms, the manner in which Newton, who was the first who systematically extended the laws of motion to the heavenly bodies, identified their results with the two remaining laws of Kepler. His "Principles of Natural Philosophy" contain general propositions with regard to any law of centripetal force, but that which he supposed to be the true one in our system, is expressed in mathematical language, by saying that the centripetal force varies inversely as the square of the distance, which means, that if the force at any distance be taken for the unit of force, at half that distance, it is two times twice, or four times as strong; at one-third the distance, three times thrice, or nine times as strong, and so for other distances. He shewed the probability of this law in the first instance by comparing the motion of the moon with that of heavy bodies at the surface of the earth. Taking L P to represent part of the moon's orbit described in one minute, the line P M between the orbit and the tangent at L would shew the space through which the central force at the earth (assuming the above principles of motion to be correct) would draw the moon. From the known distance and motion of the moon, this line P M is found to be about sixteen feet. The distance of the moon is about sixty times the radius of the earth, and therefore if the law of the central force in this instance were such as has been supposed, the force at the earth's surface would be 60 times 60, or 3600 times stronger, and at the earth's surface, the central force would make a body fall through 3600 times 16 feet in one minute. Galileo had already taught that the spaces through which a body would be made to fall, by the constant action of the same unvarying force, would be proportional to the squares of the times during which the force was exerted, and therefore according to these laws, a body at the earth's surface ought (since there are sixty seconds in a minute) to fall through 16 feet in one second, which was precisely the space previously established by numerous experiments.




With this confirmation of the supposition, Newton proceeded to the purely geometrical calculation of the law of centripetal* force necessary to make a moving body describe an ellipse round its focus, which Kepler's observations had established to be the form of the orbits of the planets round the sun. The result of the inquiry shewed that this curve required the same law of the force, varying inversely as the square of the distance, which therefore of course received additional confirmation. His method of doing this may, perhaps, be understood by referring to the last figure but one, in which C $d$, for instance, representing the space fallen from any point C towards S, in a given time, and the area C S D being proportional to the corresponding time, the space through which the body would have fallen at C in any other time (which would be greater, by Galileo's law, in proportion to the squares of the times), might be represented by a quantity varying directly as C $d$, and inversely in the duplicate proportion of the triangular area C S D, that is to say, proportional to $\frac{\mathrm{C}\,d}{(\mathrm{S\,C} \times \mathrm{D}\,k)^2}$, if D $k$ be drawn from D perpendicular on S C. If this polygon represent an ellipse, so that C D represents a small arc of the curve, of which S is the focus, it is found by the nature of that curve, that $\frac{\mathrm{C}\,d}{(\mathrm{D}\,k)^2}$ is the same at all points of the curve, so that the law of variation of the force in the same ellipse is represented solely by $\frac{1}{(\mathrm{S\,C})^2}$. If C $d$, &c. are drawn so that $\frac{\mathrm{C}\,d}{(\mathrm{D}\,k)^2}$ is not the same at every point, the curve ceases to be an ellipse whose focus is at S, as Newton has shewn in the same work. The line to which $\frac{(\mathrm{D}\,k)^2}{\mathrm{C}\,d}$ is found to be equal, is one drawn through the focus at right angles to the longest axis of the ellipse till it meets the curve;—this line is called the *latus rectum*, and is a third proportional to the two principal axes.

Kepler's third law follows as an immediate consequence of this determination; for, according to what has been already shown, the time of revolution round the whole ellipse, or, as it is com-

* In many curves, as in the circle and ellipse, there is a point to which the name of centre is given, on account of peculiar properties belonging to it: but the term "centripetal force" always refers to the place towards which the force is directed, whether or not situated in the centre of the curve.

monly called, the periodic time, bears the same ratio to the unit of time as the whole area of the ellipse does to the area described in that unit. The area of the whole ellipse is proportional in different ellipses to the rectangle contained by the two principal axes, and the area described in an unit of time is proportional to $S\,C \times D\,k$, that is to say, is in the subduplicate ratio of $S\,C^2 \times D\,k^2$, or $\frac{D\,k^2}{C\,d}$, when the force varies inversely as the square of the distance S C; and in the ellipse, as we have said already, this is equal to a third proportional to the principal axes; consequently the periodic times in different ellipses, which are proportional to the whole areas of the ellipses directly, and the areas described in the unit of time inversely, are in the compound ratio of the rectangle of the axes directly, and subduplicatly as a third proportional to the axes inversely; that is to say, the squares of these times are proportional to the cubes of the longest axes, which is Kepler's law.

## Chapter VIII.

*The Epitome prohibited at Rome—Logarithmic Tables—Trial of Catharine Kepler—Kepler invited to England—Rudolphine Tables—Death—Conclusion.*

Kepler's "Epitome," almost immediately on its appearance, enjoyed the honour of being placed by the side of the work of Copernicus, on the list of books prohibited by the congregation of the Index at Rome. He was considerably alarmed on receiving this intelligence, anticipating that it might occasion difficulties in publishing his future writings. His words to Remus, who had communicated the news to him, are as follows:—"I learn from your letter, for the first time, that my book is prohibited at Rome and Florence. I particularly beg of you, to send me the exact words of the censure, and that you will inform me whether that censure would be a snare for the author, if he were caught in Italy, or whether, if taken, he would be enjoined a recantation. It is also of consequence for me to know whether there is any chance of the same censure being extended into Austria. For if this be so, not only shall I never again find a printer there, but also the copies which the bookseller has left in Austria at my desire will be endangered, and the ultimate loss will fall upon me. It will amount to giving me to understand, that I must cease to profess Astronomy, after I have grown old in the belief of these opinions, having been hitherto gainsayed by no one,—and, in short, I must give up Austria itself, if room is no longer to be left in it for philosophical liberty." He was, however, tranquillized, in a great degree, by the reply of his friend, who told him that "the book is only prohibited as contrary to the decree pronounced by the holy office two years ago. This has been partly occasioned by a Neapolitan monk (Foscarini), who was spreading these notions by publishing them in Italian, whence were arising dangerous consequences and opinions: and besides, Galileo was at the same time pleading his cause at Rome with too much violence. Copernicus has been corrected in the same manner for some lines, at least in the beginning of his first book. But by obtaining a permission, they may be read (and, as I suppose, this "Epitome" also) by the learned and skilful in this science, both at Rome and throughout all Italy. There is therefore no ground for your alarm, either in Italy or Austria; only keep yourself within bounds, and put a guard upon your own passions."

We shall not dwell upon Kepler's different works on comets, beyond mentioning that they were divided, on the plan of many of his other publications, into three parts, Astronomical, Physical, and Astrological. He maintained that comets move in straight lines, with a varying degree of velocity. Later theories have shewn that they obey the same laws of motion as the planets, differing from them only in the extreme excentricity of their orbits. In the second book, which contains the Physiology of Comets, there is a passing remark that comets come out from the remotest parts of ether, as whales and monsters from the depth of the sea; and the suggestion is thrown out that perhaps comets are something of the nature of silkworms, and are wasted and consumed in spinning their own tails.

Among his other laborious employments, Kepler yet found time to calculate tables of logarithms, he having been one of the first in Germany to appreciate the full importance of the facilities they afford to the numerical calculator. In 1618 he wrote to his friend Schickhard: "There is a Scottish Baron (whose name has escaped my memory), who has made a famous contrivance, by which

all need of multiplication and division is supplied by mere addition and subtraction; and he does it without sines. But even he wants a table of tangents *, and the variety, frequency, and difficulty of the additions and subtractions, in some cases, is greater than the labour of multiplying and dividing."

Kepler dedicated his "Ephemeris" for 1620 to the author of this celebrated invention, Baron Napier, of Merchistoun; and in 1624, published what he called "Chilias Logarithmorum," containing the Napierian logarithms of the quotients of 100,000 divided by the first ten numbers, then proceeding by the quotients of every ten to 100, and by hundreds to 100,000. In the supplement published the following year, is a curious notice of the manner in which this subtle contrivance was at first received: "In the year 1621, when I had gone into Upper Austria, and had conferred everywhere with those skilled in mathematics, on the subject of Napier's logarithms, I found that those whose prudence had increased, and whose readiness had diminished, through age, were hesitating whether to adopt this new sort of numbers, instead of a table of sines; because they said it was disgraceful to a professor of mathematics to exult like a child at some compendious method of working, and meanwhile to admit a form of calculation, resting on no legitimate proof, and which at some time might entangle us in error, when we least feared it. They complained that Napier's demonstration rested on a fiction of geometrical motion, too loose and slippery for a sound method of reasonable demonstration to be founded on it†. "This led me forthwith to conceive the germ of a legitimate demonstration, which during that same winter I attempted, without reference to lines or motion, or flow, or any other which I may call sensible quality."

"Now to answer the question; what is the use of logarithms? Exactly what ten years ago was announced by their author, Napier, and which may be told in these words.—Wheresoever in common arithmetic, and in the Rule of Three, come two numbers to be multiplied together, there the sum of the logarithms is to be taken; where one number is to be divided by another, the difference; and the number corresponding to this sum or difference, as the case may be, will be the required product or quotient. This, I say, is the use of logarithms. But in the same work in which I gave the demonstration of the principles, I could not satisfy the unfledged arithmetical chickens, greedy of facilities, and gaping with their beaks wide open, at the mention of this use, as if to bolt down every particular gobbet, till they are crammed with my preceptícles."

The year 1622 was marked by the catastrophe of a singular adventure which befell Kepler's mother, Catharine, then nearly seventy years old, and by which he had been greatly harassed and annoyed during several years. From her youth she had been noted for a rude and passionate temper, which on the present occasion involved her in serious difficulties. One of her female acquaintance, whose manner of life had been by no means unblemished, was attacked after a miscarriage by violent headaches, and Catharine, who had often taken occasion to sneer at her notorious reputation, was accused with having produced these consequences, by the administration of poisonous potions. She repelled the charge with violence, and instituted an action of scandal against this person, but was unlucky (according to Kepler's statement) in the choice of a young doctor, whom she employed as her advocate. Considering the suit to be very instructive, he delayed its termination during five years, until the judge before whom it was tried was displaced. He was succeeded by another, already indisposed against Catharine Kepler, who on some occasion had taunted him with his sudden accession to wealth from a very inferior situation. Her opponent, aware of this advantage, turned the ta-

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* The meaning of this passage is not very clear: Kepler evidently had seen and used logarithms at the time of writing this letter; yet there is nothing in the method to justify this expression,—"*At tamen opus est ipsi Tangentium canone.*"

† This was the objection originally made to Newton's "Fluxions," and in fact, Napier's idea of logarithms is identical with that method of conceiving quantities. This may be seen at once from a few of his definitions,

1 Def. A line is said to increase uniformly, when the point by which it is described passes through equal intervals, in equal times.

2 Def. A line is said to diminish to a shorter one proportionally, when the point passing along it cuts off in equal times segments proportional to the remainder.

6 Def. The logarithm of any sine is the number most nearly denoting the line, which has increased uniformly, whilst the radius has diminished to that sine proportionally, the initial velocity being the same in both motions. (Mirifici logarithmorum canonis descriptio, Edinburgi 1614.)

This last definition contains what we should now call the differential equation between a number and the logarithm of its reciprocal.

bles on her, and in her turn became the accuser. The end of the matter was, that in July, 1620, Catharine was imprisoned, and condemned to the torture. Kepler was then at Linz, but as soon as he learned his mother's danger, hurried to the scene of trial. He found the charges against her supported only by evidence which never could have been listened to, if her own intemperate conduct had not given advantage to her adversaries. He arrived in time to save her from the question, but she was not finally acquitted and released from prison till November in the following year. Kepler then returned to Linz, leaving behind him his mother, whose spirit seemed in no degree broken by the unexpected turn in the course of her litigation. She immediately commenced a new action for costs and damages against the same antagonist, but this was stopped by her death, in April 1622, in her seventy-fifth year.

In 1620 Kepler was visited by Sir Henry Wotton, the English ambassador at Venice, who finding him, as indeed he might have been found at every period of his life, oppressed by pecuniary difficulties, urged him to go over to England, where he assured him of a welcome and honourable reception; but Kepler could not resolve upon the proposed journey, although in his letters he often returned to the consideration of it. In one of them, dated a year later, he says, "The fires of civil war are raging in Germany—they who are opposed to the honour of the empire are getting the upper hand—everything in my neighbourhood seems abandoned to flame and destruction. Shall I then cross the sea, whither Wotton invites me? I, a German? a lover of firm land? who dread the confinement of an island? who presage its dangers, and must drag along with me my little wife and flock of children? Besides my son Louis, now thirteen years old, I have a marriageable daughter, a two-year old son by my second marriage, an infant daughter, and its mother but just recovering from her confinement." Six years later, he says again,—"As soon as the Rudolphine Tables are published, my desire will be to find a place where I can lecture on them to a considerable assembly; if possible, in Germany; if not, why then in Italy, France, the Netherlands, or England, provided the salary is adequate for a traveller."

In the same year in which he received this invitation an affront was put upon Kepler by his early patrons, the States of Styria, who ordered all the copies of his "Calendar," for 1624, to be publicly burnt. Kepler declares that the reason of this was, that he had given precedence in the title-page to the States of Upper Ens, in whose service he then was, above Styria. As this happened during his absence in Wirtemberg, it was immediately coupled by rumour with his hasty departure from Linz: it was said that he had incurred the Emperor's displeasure, and that a large sum was set upon his head. At this period Matthias had been succeeded by Ferdinand III., who still continued to Kepler his barren title of imperial mathematician.

In 1624 Kepler went to Vienna, in the hopes of getting money to complete the Rudolphine Tables, but was obliged to be satisfied with the sum of 6000 florins and with recommendatory letters to the States of Suabia, from whom he also collected some money due to the emperor. On his return he revisited the University of Tubingen, where he found his old preceptor, Mästlin, still alive, but almost worn out with old age. Mästlin had well deserved the regard Kepler always appears to have entertained for him; he had treated him with great liberality whilst at the University, where he refused to receive any remuneration for his instruction. Kepler took every opportunity of shewing his gratitude; even whilst he was struggling with poverty he contrived to send his old master a handsome silver cup, in acknowledging the receipt of which Mästlin says,—"Your mother had taken it into her head that you owed me two hundred florins, and had brought fifteen florins and a chandelier towards reducing the debt, which I advised her to send to you. I asked her to stay to dinner, which she refused: however, we handselled your cup, as you know she is of a thirsty temperament."

The publication of the Rudolphine Tables, which Kepler always had so much at heart, was again delayed, notwithstanding the recent grant, by the disturbances arising out of the two parties into which the Reformation had divided the whole of Germany. Kepler's library was sealed up by desire of the Jesuits, and nothing but his connexion with the Imperial Court secured to him his own personal indemnity. Then followed a popular insurrection, and the

peasantry blockaded Linz, so that it was not until 1627 that these celebrated tables finally made their appearance, the earliest calculated on the supposition that the planets move in elliptic orbits. Ptolemy's tables had been succeeded by the "Alphonsine," so called from Alphonso, King of Castile, who, in the thirteenth century, was an enlightened patron of astronomy. After the discoveries of Copernicus, these again made way for the Prussian, or Prutenic tables, calculated by his pupils Reinhold and Rheticus. These remained in use till the observations of Tycho Brahe showed their insufficiency, and Kepler's new theories enabled him to improve upon them. The necessary types for these tables were cast at Kepler's own expense. They are divided into four parts, the first and third containing a variety of logarithmic and other tables, for the purpose of facilitating astronomical calculations. In the second are tables of the elements of the sun, moon, and planets. The fourth gives the places of 1000 stars as determined by Tycho, and also at the end his table of refractions, which appears to have been different for the sun, moon, and stars. Tycho Brahe assumed the horizontal refraction of the sun to be 7′ 30″, of the moon 8′, and of the other stars 3′. He considered all refraction of the atmosphere to be insensible above 45° of altitude, and even at half that altitude in the case of the fixed stars. A more detailed account of these tables is here obviously unsuitable: it will be sufficient to say merely, that if Kepler had done nothing in the course of his whole life but construct these, he would have well earned the title of a most useful and indefatigable calculator.

Some copies of these tables have prefixed to them a very remarkable map, divided by hour lines, the object of which is thus explained:—

"The use of this nautical map is, that if at a given hour the place of the moon is known by its edge being observed to touch any known star, or the edges of the sun, or the shadow of the earth; and if that place shall (if necessary) be reduced from apparent to real by clearing it of parallax; and if the hour at Uraniburg be computed by the Rudolphine tables, when the moon occupied that true place, the difference will show the observer's meridian, whether the picture of the shores be accurate or not, for by this means it may come to be corrected."

This is probably one of the earliest announcements of the method of determining longitudes by occultations; the imperfect theory of the moon long remained a principal obstacle to its introduction in practice. Another interesting passage connected with the same object may be introduced here. In a letter to his friend Cruger, dated in 1616, Kepler says: "You propose a method of observing the distances of places by sundials and automata. It is good, but needs a very accurate practice, and confidence in those who have the care of the clocks. Let there be only one clock, and let it be transported; and in both places let meridian lines be drawn with which the clock may be compared when brought. The only doubt remaining is, whether a greater error is likely from the unequal tension in the automaton, and from its motion, which varies with the state of the air, or from actually measuring the distances. For if we trust the latter, we can easily determine the longitudes by observing the differences of the height of the pole."

In an Appendix to the Rudolphine Tables, or, as Kepler calls it, "an alms doled out to the nativity casters," he has shown how they may use his tables for their astrological predictions. Everything in his hands became an allegory; and on this occasion he says, —"Astronomy is the daughter of Astrology, and this modern Astrology, again, is the daughter of Astronomy, bearing something of the lineaments of her grandmother; and, as I have already said, this foolish daughter, Astrology, supports her wise but needy mother, Astronomy, from the profits of a profession not generally considered creditable."

Soon after the publication of these tables, the Grand Duke of Tuscany sent him a golden chain; and if we remember the high credit in which Galileo stood at this time in Florence, it does not seem too much to attribute this honourable mark of approbation to his representation of the value of Kepler's services to astronomy. This was soon followed by a new and final change in his fortunes. He received permission from the emperor to attach himself to the celebrated Duke of Friedland, Albert Wallenstein, one of the most remarkable men in the history of that time.

Wallenstein was a firm believer in astrology, and the reception Kepler experienced by him was probably due, in great measure, to his reputation in that art. However that may be, Kepler found in him a more munificent patron than any one of his three emperors ; but he was not destined long to enjoy the appearance of better fortune. Almost the last work which he published was a commentary on the letter addressed, by the missionary Terrentio, from China, to the Jesuits at Ingolstadt. The object of this communication was to obtain from Europe means for carrying into effect a projected scheme for improving the Chinese calendar. In this essay Kepler maintains the opinion, which has been discussed with so much warmth in more modern times, that the pretended ancient observations of the Chinese were obtained by computing them backwards from a much more recent date. Wallenstein furnished him with an assistant for his calculations, and with a printing press ; and through his influence nominated him to the professorship in the University of Rostoch, in the Duchy of Mecklenburg. His claims on the imperial treasury, which amounted at this time to 8000 crowns, and which Ferdinand would gladly have transferred to the charge of Wallenstein, still remained unsatisfied. Kepler made a last attempt to obtain them at Ratisbon, where the imperial meeting was held, but without success. The fatigue and vexation occasioned by his fruitless journey brought on a fever, which unexpectedly put an end to his life, in the early part of November, 1630, in his fifty-ninth year. His old master, Mästlin, survived him for about a year, dying at the age of eighty-one.

Kepler left behind him two children by his first wife, Susanna and Louis ; and three sons and two daughters, Sebald, Cordelia, Friedman, Hildebert, and Anna Maria, by his widow. Susanna married, a few months before her father's death, a physician named Jacob Bartsch, the same who latterly assisted Kepler in preparing his "Ephemeris." He died very shortly after Kepler himself. Louis studied medicine, and died in 1663, whilst practising as a physician at Konigsberg. The other children died young.

Upon Kepler's death the Duke of Friedland caused an inventory to be taken of his effects, when it appeared that near 24,000 florins were due to him, chiefly on account of his salary from the emperor. His daughter Susanna, Bartsch's widow, managed to obtain a part of these arrears by refusing to give up Tycho Brahe's observations till her claims were satisfied. The widow and younger children were left in very straightened circumstances, which induced Louis, Kepler's eldest son, to print, for their relief, one of his father's works, which had been left by him unpublished. It was not without much reluctance, in consequence of a superstitious feeling which he did not attempt to conceal or deny. Kepler himself, and his son-in-law, Bartsch, had been employed in preparing it for publication at the time of their respective deaths ; and Louis confessed that he did not approach the task without apprehension that he was incurring some risk of a similar fate. This little rhapsody is entitled a "Dream on Lunar Astronomy;" and was intended to illustrate the appearances which would present themselves to an astronomer living upon the moon.

The narrative in the dream is put into the mouth of a personage, named Duracoto, the son of an Icelandic enchantress, of the name of Fiolxhildis. Kepler tells us that he chose the last name from an old map of Europe in his house, in which Iceland was called Fiolx: Duracoto seemed to him analogous to the names he found in the history of Scotland, the neighbouring country. Fiolxhildis was in the habit of selling winds to mariners, and used to collect herbs to use in her incantations on the sides of Mount Hecla, on the Eve of St. John. Duracoto cut open one of his mother's bags, in punishment of which she sold him to some traders, who brought him to Denmark, where he became acquainted with Tycho Brahe. On his return to Iceland, Fiolxhildis received him kindly, and was delighted with the progress he had made in astronomy. She then informed him of the existence of certain spirits, or demons, from whom, although no traveller herself, she acquired a knowledge of other countries, and especially of a very remarkable country, called Livania. Duracoto requesting further information, the necessary ceremonies were performed for invoking the demon ; Duracoto and his mother enveloped their heads in their clothing, and presently "the screaking of a harsh dissonant voice began to speak

in the Icelandic tongue." The island of Livania is situated in the depths of ether, at the distance of about 250000 miles; the road thence or thither is very seldom open, and even when it is passable, mankind find the journey a most difficult and dangerous one. The demon describes the method employed by his fellow spirits to convey such travellers as are thought fit for the undertaking: "We bring no sedentary people into our company, no corpulent or delicate persons; but we pick out those who waste their life in the continual use of post-horses, or who sail frequently to the Indies; who are accustomed to live upon biscuit, garlic, dried fish, and such abominable feeding. Those withered old hags are exactly fit for us, of whom the story is familiar that they travel immense distances by night on goats, and forks, and old petticoats. The Germans do not suit us at all; but we do not reject the dry Spaniards." This extract will probably be sufficient to show the style of the work. The inhabitants of Livania are represented to be divided into two classes, the Privolvans and Subvolvans, by whom are meant those supposed to live in the hemisphere facing the earth, which is called the Volva, and those on the opposite half of the moon: but there is nothing very striking in the account given of the various phenomena as respects these two classes. In some notes which were added some time after the book was first written, are some odd insights into Kepler's method of composing. Fiolxhildis had been made to invoke the dæmon with twenty-one characters; Kepler declares, in a note, that he cannot remember why he fixed on this number, "except because that is the number of letters in *Astronomia Copernicana*, or because there are twenty-one combinations of the planets, two together, or because there are twenty-one different throws upon two dice." The dream is abruptly terminated by a storm, in which, says Kepler, "I suddenly waked; the Demon, Duracoto, and Fiolxhildis were gone, and instead of their covered heads, I found myself rolled up among the blankets."

Besides this trifle, Kepler left behind him a vast mass of unpublished writings, which came at last into the hands of his biographer, Hantsch. In 1714, Hantsch issued a prospectus for publishing them by subscription, in twenty-two folio volumes. The plan met no encouragement, and nothing was published but a single folio volume of letters to and from Kepler, which seem to have furnished the principal materials for the memoir prefixed to them. After various unavailing attempts to interest different learned bodies in their appearance, the manuscripts were purchased for the library at St. Petersburg, where Euler, Lexell, and Kraft, undertook to examine them, and select the most interesting parts for publication. The result of this examination does not appear.

Kepler's body was buried in St. Peter's churchyard at Ratisbon, and a simple inscription was placed on his tombstone. This appears to have been destroyed not long after, in the course of the wars which still desolated the country. In 1786, a proposal was made to erect a marble monument to his memory, but nothing was done. Kästner, on whose authority it is mentioned, says upon this, rather bitterly, that it matters little whether or not Germany, having almost refused him bread during his life, should, a century and a half after his death, offer him a stone.

Delambre mentions, in his History of Astronomy, that this design was resumed in 1803 by the Prince Bishop of Constance, and that a monument has been erected in the Botanical Garden at Ratisbon, near the place of his interment. It is built in the form of a temple, surmounted by a sphere; in the centre is placed a bust of Kepler, in Carrara marble. Delambre does not mention the original of the bust; but says it is not unlike the figure engraved in the frontispiece of the Rudolphine Tables. That frontispiece consists of a portico of ten pillars, supporting a cupola covered with astronomical emblems. Copernicus, Tycho Brahe, Ptolemy, Hipparchus, and other astronomers, are seen among them. In one of the compartments of the common pedestal is a plan of the observatory at Uraniburg; in another, a printing press; in a third is the figure of a man, meant for Kepler, seated at a table. He is identified by the titles of his works, which are round him; but the whole is so small as to convey very little idea of his figure or countenance. The only portrait known of Kepler was given by him to his assistant Gringallet, who presented it to Bernegger; and it was placed by the latter in the library at Strasburg. Hantsch had a copy taken for the purpose of engraving it, but died before it was

completed. A portrait of Kepler is engraved in the seventh part of Boissard's Bibliotheca Chalcographica. It is not known whence this was taken, but it may, perhaps, be a copy of that which was engraved by desire of Bernegger in 1620. The likeness is said not to have been well preserved. "His heart and genius," says Kästner, "are faithfully depicted in his writings; and that may console us, if we cannot entirely trust his portrait." In the preceding pages, it has been endeavoured to select such passages from his writings as might throw the greatest light on his character, with a subordinate reference only to the importance of the subjects treated. In conclusion, it may be well to support the opinion which has been ventured on the real nature of his triumphs, and on the danger of attempting to follow his method in the pursuit of truth, by the judgment pronounced by Delambre, as well on his failures as on his success. "Considering these matters in another point of view, it is not impossible to convince ourselves that Kepler may have been always the same. Ardent, restless, burning to distinguish himself by his discoveries, he attempted everything; and having once obtained a glimpse of one, no labour was too hard for him in following or verifying it. All his attempts had not the same success, and, in fact, that was impossible. Those which have failed seem to us only fanciful; those which have been more fortunate appear sublime. When in search of that which really existed, he has sometimes found it; when he devoted himself to the pursuit of a chimera, he could not but fail; but even there he unfolded the same qualities, and that obstinate perseverance that must triumph over all difficulties but those which are insurmountable*."

* Histoire de l'Astronomie Moderne, Paris, 1821.

## *List of Kepler's published Works.*

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|---|---|
| Ein Calender | *Gratz*, 1594 |
| Prodromus Dissertat. Cosmograph. | *Tubingæ*, 1596, 4to. |
| De fundamentis Astrologiæ | *Pragæ*, 1602, 4to. |
| Paralipomena ad Vitellionem | *Francofurti*, 1604, 4to. |
| Epistola de Solis deliquio | 1605 |
| De stellâ novâ | *Pragæ*, 1606, 4to. |
| Vom Kometen | *Halle*, 1608, 4to. |
| Antwort an Röslin | *Pragæ*, 1609, 4to. |
| Astronomia Nova | *Pragæ*, 1609, fol. |
| Tertius interveniens | *Frankfurt*, 1610, 4to. |
| Dissertatio cum Nuncio Sidereo | *Francofurti*, 1610, 4to. |
| Strena, seu De nive sexangulâ | *Frankfurt*, 1611, 4to. |
| Dioptrica | *Francofurti*, 1611, 4to. |
| Vom Geburts Jahre des Heylandes | *Strasburg*, 1613, 4to. |
| Respons. ad epist S. Calvisiii | *Francofurti*, 1614, 4to. |
| Eclogæ Chronicæ | *Frankfurt*, 1615, 4to. |
| Nova Stereometria | *Lincii*, 1615, 4to. |
| Ephemerides 1617—1620 | *Lincii*, 1616, 4to. |
| Epitomes Astron. Copern. Libri i. ii. iii. | *Lentiis*, 1618, 8vo. |
| De Cometis | *Aug. Vindelic.* 1619, 4to. |
| Harmonice Mundi | *Lincii*, 1619, fol. |
| Kanones Pueriles | *Ulmæ*, 1620 |
| Epitomes Astron. Copern. Liber iv. | *Lentiis*, 1622, 8vo. |
| Epitomes Astron. Copern. Libri v. vi. vii. | *Francofurti*, 1622, 8vo. |
| Discurs von der grossen Conjunction | *Linz*. 1623, 4to. |
| Chilias Logarithmorum | *Marpurgi*, 1624, fol. |
| Supplementum | *Lentiis*, 1625, 4to. |
| Hyperaspistes | *Francofurti*, 1625, 8vo. |
| Tabulæ Rudolphinæ | *Ulmæ*, 1627, fol. |
| Resp. ad epist. J. Bartschii | *Sagani*, 1629, 4to. |
| De anni 1631 phænomenis | *Lipsæ*, 1629, 4to. |
| Terrentii epistolium cum commentatiunculâ | *Sagani*, 1630, 4to. |
| Ephemerides | *Sagani*, 1630, 4to. |

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|---|---|
| Somnium | *Francofurti*, 1634, 4to. |
| Tabulæ manuales | *Argentorati*, 1700, 12mo. |

(11)

DRAPER, William

# LIFE OF DR. ADAM SMITH.

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*Introduction.*

It is well known that the late lamented Dugald Stewart, amidst the profound and comprehensive studies to which his life was dedicated, became the biographer of three of his countrymen—two of them being amongst the most distinguished of whom Scotland has to boast: these were, Dr. Robertson the historian, and Adam Smith. His friend and tutor, Dr. Reid, we place, where we conceive the world has placed him, in a rank far below these, and where we cannot but think Mr. Stewart would himself have placed him, if his affectionate remembrance of his early instructor had left his judgment perfectly impartial with respect to Dr. Reid's merits as a philosopher.

Since the days of the Memorabilia, when Xenophon became the biographer of Socrates, there has been seen perhaps no proportion so equal betwixt the writer and his subject, as when Dugald Stewart wrote the "Memoirs of the Life and Writings of Adam Smith." Yet, congenial as was the theme, and beautifully as he has illustrated the *writings*, there is a deficiency in the *life*. It was observed of Mallet, that he wrote the life of Lord Bacon, and forgot that he was a philosopher. This, at least, cannot be said of Mr. Stewart. He has kept the philosopher so much in mind, that he has almost forgotten the man. In his review of the works of the distinguished person, in his criticism and his comments, we find everything that we can desire and might expect, even from the pen of Mr. Stewart; but we look in vain for those traits of personal character, those slight yet important incidents and anecdotes which marked the individual, which, when preserved and depicted, form the great charm of biography, and which serve, far more than the most laboured disquisition or panegyric, to recommend to us, and quicken our interest in, the circumstances by which the subject of the memorial acquired his celebrity. Mr. Stewart seems to have entertained a difference of opinion upon this point; possibly he deemed it beneath the dignity of the life of a philosopher. Yet the earliest and most amusing, if not most accurate of biographers thought otherwise. "It is not always," says Plutarch, "in the most distinguished exploits that men's virtues or vices may be best discerned; but frequently an action of small note, a short saying or a jest distinguishes a person's real character more than the greatest battles or the most important actions. As painters labour the likeness in the face, so must we be permitted to strike off the features of the soul, in order to give a real likeness to these great men*." Upon this principle has this inimitable writer left us a record of the lives of upwards of fifty warriors, legislators, and statesmen, investing them with an interest and a wisdom which will delight and instruct the last generations of mankind.

There may have been biographers who have carried their passion for detail and minute anecdote somewhat too far, but even in such cases we feel it is rather ungrateful to condemn them; and we might take the very extreme of this class, even Boswell himself, with all his faults, and almost challenge the world to produce another book of biography of equal interest with the Life of Johnson.

But betwixt Plutarch and Boswell there is an interval, almost as wide as between Auchinleck and Chæronea; and Mr. Stewart ought not, perhaps, strictly to have conformed himself to the example of either. Yet we cannot but regret that much that would interest us has been lost for ever; those many peculiarities, those lights and shadows which would have made us familiar with the man, and given a graphic reality to the portrait. Mr. Stewart was the personal friend of Adam Smith during many of his latter years; and for all that related to him previously, it would have been the easiest thing in the world to have collected information and anecdote in the society of Edinburgh. If it be one object, as it must be presumed of the biographer, to extend the fame of the person whose life he undertakes to record, surely it must be obvious how

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* Plutarch—Life of Alexander.

much is lost in this respect by this partial mode of exhibiting him.

"The else unvalued circumstances in the lives of literary men" (says Mr. Mackenzie in his "Memoir of the Life of John Home") "acquire an interest with the reader, proportionate to that which the writings of the author have excited; and we are anxious to know every little occurrence which befel him, who was giving, at the period when these occurrences took place, the product of his mind to the public. We are anxious to know how the world treated a man who was labouring for its instruction or amusement, as well as the effect which his private circumstances had on his literary productions, or the complexion, as one may term it, which those productions borrowed from the incidents of his life. These considerations afford an apology for the narratives of the comparatively unimportant occupations which the world peruses with so much interest —they help that personification of an author which the reader of his work so naturally indulges; and if they sometimes put him right in his estimate of the influence of genius or feeling upon conduct, they serve at the same time as a moral lesson on the subject, and a mark as it were of the unexpected shores or islands, sometimes it may be rocks or quicksands, on the chart of life."

## Section 2.—*From the birth of Dr. Smith till the publication of the "Theory of Moral Sentiments."*

Adam Smith was born at Kirkaldy, in Fifeshire, on the 5th of June, 1723. His father was comptroller of the customs at that place, and had in early life practised as a writer to the signet in Edinburgh. He had been for some years private secretary to the Earl of Loudon, when he received his appointment to the customs at Kirkaldy. His wife was the daughter of Mr. Douglas, of Strathenry; and Adam was the only issue of their marriage. His mother lived long enough to enjoy the celebrity of her son; but he had the misfortune never to have known the care and affection of his father, whose death took place a few months previous to the birth of his distinguished offspring. His constitution during infancy, we are informed, was weak and sickly, and required the tenderest solicitude of his surviving parent for the preservation of his life. It is remarkable that in this respect a nearly similar fortune should have attended two of the most remarkable men whom Scotland has produced. It was the fate of Hume to lose his father in his infancy, and to owe, like Smith, to a widowed mother, all the protection and care so requisite at that early period. The mother of our young philosopher was, by some persons, accused of over-indulging her son, but the indulgence of the parent was best vindicated by the growing temper and disposition of the child; and Mrs. Smith during her long life (which extended till within twelve years of the death of her son) had never occasion to reproach herself for any indiscreet kindness, but had the happiness to see her parental care acknowledged to the hour of her death, by every attention which filial affection could prompt.

An accident befel him when he was about three years of age, which, if it had not proved fatal to his life, might have strangely altered his future destiny, and might thus, perhaps, have influenced, in no small degree, the progress of political science in Europe. He had been on a visit to his uncle, Mr. Douglas of Strathenry; and as he was one day amusing himself at the door of the house, he was carried off by a party of gipsies. Happily he was very soon missed by his uncle, who having learned that a set of vagrants had recently passed that way, pursued and overtook them in Leslie Wood—with feelings with which it is easy to sympathize, even without reference to the importance of the life he had preserved.

When the period arrived at which it was deemed proper that he should be sent to school, he was placed under the care of Mr. David Miller, who then taught the school at Kirkaldy,—a person who enjoyed no inconsiderable reputation as a teacher in his day, and who had the fortune to educate, about the same period, a few men of greater eminence in after life than are frequently to be found registered in so obscure a seminary. With some of these Smith contracted an intimacy which lasted during their lives. We are not exactly informed of the time when he was placed under Mr. Miller's care, but we know that he remained with him till he attained his fourteenth year. His great love of books, even in those early years, attracted the notice of his schoolfellows, as did the extraordinary powers of his memory, and those habits of mental abstraction for which he was remarkable

throughout life. His love of reading was indulged and strengthened the more, owing to the weakness of his constitution, which prevented his joining in the more active pastimes of his companions. Their fondness for him was not lessened by habits which schoolboys in general might be apt to regard as unsocial, but it arose from the excellence of his temper, and the warm and generous feelings which distinguished him.

It is to be regretted that we know so little of the nature of his reading at this period of his life. That he was well grounded in the dead languages, and that the classic writers of Greece and Rome were favourite objects of his study whilst he was under the care of Mr. Miller, may safely be presumed. His works afford abundant evidence of the extent of his acquirements in this department of literature, a relish for which never deserted him in after life, even amidst the profound inquiries which occupied his attention while engaged in the composition of his greatest work. Had Dr. Smith, however, like Gibbon, become his own biographer, or like Johnson, had he had the fortune to leave behind him such a chronicler as Boswell, we might then have seen, perhaps in the earliest unprescribed studies of the recluse student at Kirkaldy, the first indications of that tendency of mind and mode of thinking which gave promise of the future author of the "Wealth of Nations."

In 1737, at the age of fourteen, he left Kirkaldy, and was removed to the University of Glasgow, where he had the happiness of studying under Dr. Francis Hutcheson, of whom he always spoke, as he has written, in terms of the highest admiration. The lectures of that distinguished professor may be fairly considered as having first directed his views to that branch of ethical philosophy so beautifully illustrated in the "Theory of Moral Sentiments," which he afterwards gave to the world, and in which he has equal merit in having confirmed what was right, and corrected what was wrong in the speculations of his eloquent tutor. It is said, however, that Mathematics and Natural Philosophy engaged the greater portion of his attention during his residence at Glasgow; but his "History of Astronomy" in the Posthumous Essays is the only one of his writings in which we discover much of the fruits of his acquaintance with those sciences. His illustrations are almost always drawn from history, poetry, and polite literature; and, though he prized the persons and the characters of mathematicians and natural philosophers, and has judged highly (perhaps partially) of the tendency of such studies upon the temper and morals of the individual*, it is quite clear that they were neither so congenial to his taste, nor did he estimate their importance to the interests of mankind as being in any respect equal to that of other branches of philosophy, and those more especially which he afterwards himself so largely illustrated and advanced. To these latter, therefore, to the history of mankind, to the moral, economical, and political phases which are presented in its progress, we may be assured, without any particular testimony, that his attention was very early directed, and for a long period of years in a great measure confined. But we have one fact that goes strikingly in proof of this, which is interesting on many accounts, and not the least so as pointing out the first and only book which we know to have been read by him about this period, and which must have been read from love alone, since it was read by stealth.

In 1740, after three years spent at Glasgow, he was removed to the university of Oxford, and entered at Baliol College as an exhibitioner on Snell's foundation. It would appear that shortly after his arrival there, from some cause or other he had given occasion to suspect that his private hours were not always devoted to such books as the discipline of Oxford prescribes to its students; and it was determined therefore by the heads of the college, with more of zeal than honour, that the young philosopher from the north should be taken by surprise in his chamber, in order to ascertain whether the nature of his studies was really orthodox or not. Unluckily, he was found reading the "Treatise of Human Nature," then recently published, and the discovery was of course followed by a severe reprimand and the forfeiture of the forbidden volume. Smith, at that time, knew perhaps nothing more of the book he was perusing than that it was the production of a young Scotchman—a work, which as the author of it said himself, "fell dead-born from the press," little known and a good deal decried, but recommended to Smith by the subject

* Vide Theory of Moral Sent., Part III., Ch. 2.

of which it treats, by his love of metaphysics, and the profound and original speculations which it contained; as inviting to the young and free inquirer as they were alarming to the heads of the university. It was not till some years after this that the immortal author of the work in question became known to his young disciple, and that that enduring friendship was cemented betwixt them, which both of them have taken pains to record—" a friendship on both sides founded on the admiration of genius and the love of simplicity," as Mr. Stewart has beautifully expressed it, and which, without biassing the judgment of Smith, must have exalted the pride and the pleasure which he felt, when years after this, he cited him in the "Wealth of Nations" in language which many have thought savoured rather of the warmth of friendship than the calmness of sober judgment, as *by far the most illustrious philosopher and historian of the present age**.

When Smith was sent to Oxford, it had been the intention of his family that he should study for the Church of England. He remained seven years at that renowned seat of learning; but long before he left it, not finding the ecclesiastical profession suited to his taste, he had abandoned all such intention, and preferred the hopes of such small emolument as his literary attainments might procure for him in his own country, to the higher prospects which the prudence of his friends had pointed out. As there is every reason to admire the independence of mind which induced him to abandon those prospects, we can have none to regret it on any other ground, from the direction which was thus given to the studies and the labours of his future life. There is no doubt that had Dr. Smith voluntarily made the Church his profession, he would have adorned it by genius and learning, that the purity of his life would have added force to the precepts which it would have been his duty to inculcate as a Christian teacher. But this advantage would have been too dearly purchased. The Church would more easily find a substitute for Smith as one of its ministers, than the world might have found one like him, capable of unfolding for its instruction those laws equally divine in their origin and beneficent in their results when rightly apprehended, which regulate the order and advance the moral and political condition of society. The mind of Smith, which found in such subjects a boundless field for his contemplations, might have been confined, and at length contracted, by the professional study of theological learning. The great truths of religion are as simple as they are sublime; and their simplicity renders useless much that human ingenuity can do, while their sublimity defies it. To know God, says Seneca, is to worship him. And much of this knowledge is attained by looking attentively upon the glories of his creation.

It is to be lamented that we know so little of the life of Smith during that part of it which was passed at Oxford. What he thought of that university, of its discipline and its studies, he told the world many years after in a memorable passage of the "Wealth of Nations *," which has never been forgiven by the worshippers of Oxford, and by all those who are prone to consider it a crime to point out the defects of any ancient institution. Strange it may seem that there should always be a number of persons prone to such a course, seeing that the corruptions and abuses which are incident to establishments of this kind, like the diseases in the animal body, have a natural tendency to bring on decay, and that the best friend to such institutions, like the best physician, is he who first discovers the disorder—a discovery necessarily antecedent to the suggestion of the remedy. Yet there are few mistakes so common as this in the world, and few more fatal to its improvement. It is the error of preferring the means to the end, the mere instrument, an instrument often worn out, and sometimes become useless, to the excellent purposes it was designed to work. It may be proper to enlarge a little upon this topic, on account of the unjust prejudice that has been excited against Dr. Smith, in consequence of his animadversions upon Oxford, and is constantly excited for the worst purposes against men like him, whose enlightened and benevolent efforts for the improvement of public institutions, instead of gratitude, have often experienced calumny and opposition. If Smith censured the discipline, or rather the want of discipline, and the abandonment of duty in the tutors and professors of Oxford in his day, what possible motive

* Book v. Ch. 1.

* Book v. Ch. 1. Part 3.

could he have that is reconcileable with the acknowledged qualities of the man, but a zeal, a warm and indignant zeal, it may be, in behalf of that learning and science which was going to ruin, by the neglect of those who were appointed for their conservation? Of course it is unnecessary to say that we refer not to Oxford as it now is; but if it has been reformed since the days of Smith, it has been reformed only, because some have been found bold and wise enough, like him and after him, to proclaim that it stood in need of such reformation. Far be it from us, and from every friend of learning, to abate that just veneration for the institutions of our country; those especially which have the promotion of science and of virtue for their object, which is really their due—due often to their antiquity — to the excellence of their founders—and to the long catalogue of illustrious men who have been bred under them, and whose wisdom and learning, whose virtue and heroism in after life, seem, by a very natural and pleasing illusion, to become identified with the places in which they were educated.

Of the seven years which Smith passed at Oxford little, indeed, has been recorded. We have scarcely an incident relating to his private life, and as little do we know respecting his intellectual habits. Mr. Stewart presumes that he cultivated with particular care, at this time, the study of languages;—a study for which it would seem he had an unusual fondness, and in which, at all events, he is known to have excelled. But Smith studied languages more as a philosopher than a scholar, as they serve to throw light on the manners, the institutions, the modes of thought peculiar to different nations and ages. His knowledge of Greek was profound and accurate; and his taste and high admiration for the drama and literature of the Greeks, preserved to the latest period of his life, may be best traced to the studies and the society in which he mixed whilst at the university. Mr. Dalzell, the distinguished professor of Greek in the University of Edinburgh, has borne testimony to the extent and accuracy of Dr. Smith's acquaintance with that noble language, as often displayed in conversation with him on some of the nicest minutiæ of grammatical criticism. He was accustomed at this time to exercise himself in translation from various languages, chiefly French; and always spoke of it as useful for the acquisition of the art of composition, and for improvement in style. Gibbon has recommended the same practice in his own Memoirs, and a mode of study, we may venture to say, which was pursued and praised by two such distinguished writers, is well worth the attention of all who cultivate literature.

Upon quitting Oxford, Smith returned to Kirkaldy, where he continued to reside with his mother for two years, with the most ardent application to study. In 1748 he removed to Edinburgh, and there commenced his connexion and friendship with many of the distinguished men who then adorned that city; and composed a society which included within its range an extent and variety of accomplishments, and a depth and solidity of philosophy and of learning, not easily equalled in any other, at any period of modern Europe. Among its members we find a vast portion of the names familiar to us, from having enriched the literature of our country in various departments, about the middle of the last century. Those of Hume and Robertson, of Blair, of Ferguson, of Lord Kames and John Home, are known to every reader; but there were others not less accomplished though less known to posterity, whose genius and talents added lustre, even to so brilliant an assemblage of men; Lord Elibank, Sir Gilbert Elliot, Lord Loughborough, Sir William Pulteney, Lord Monboddo, Dr. Logan; these, and many others, we find enumerated in the "Select Society," which was formed in Edinburgh about that period; the list of which Mr. Stewart has preserved*. At this time commenced his memorable friendship with David Hume, the philosopher who had led the way into those very regions of moral and political inquiry, where Smith was destined to follow, guided chiefly, as he always confessed, and as was admitted by his admirers, by that light which had been shed upon them by the most subtle intellect, perhaps, which ancient or modern Europe has produced †.

It was not long after his settlement in Edinburgh, that the friendly patronage of Lord Kames induced Smith to com-

* Appendix to the Life of Robertson.

† It is hardly necessary to remind the reader that, in the panegyrics pronounced upon Hume, we refer merely to his celebrated writings upon moral and political science, and not to those upon religion.

mence a course of Lectures on Rhetoric and Belles Lettres, which he continued for a considerable time; until the high reputation which he had earned, seconded by the zeal of his friends, procured for him, in 1751, the professorship of Logic in the university of Glasgow. In 1752, upon the death of Mr. Thomas Craigie, he was advanced to the chair of Moral Philosophy in the same University; an office which he continued to fill for thirteen years;—a period which he was accustomed to look back upon, as the most useful and happy of his life. "It was indeed a situation," says his biographer, "in which he was eminently fitted to excel, and in which the daily labours of his profession were constantly recalling his attention to his favourite pursuits, and familiarising his mind to those important speculations he was afterwards to communicate to the world."

It is greatly to be regretted, that no part of his lectures whilst at Glasgow, has been preserved; but the following brief and very interesting account of them was furnished by one of Dr. Smith's pupils, who afterward became one of his warmest and latest friends. There is no necessity to apologise for presenting it to our readers, seeing that we cannot better supply the vacuum that would otherwise be left, owing to the very scanty materials which remain for a life of this distinguished man. "In the professorship of logic," says one of his students, "to which Dr. Smith was appointed on his first introduction to this university, he soon saw the necessity of departing widely from the plan that had been followed by his predecessors; and of directing the attention of his pupils to studies of a more interesting and useful nature than the logic and metaphysics of the schools. Accordingly after exhibiting a general view of the powers of the mind, and explaining so much of the ancient logic as was requisite to gratify curiosity, with respect to an artificial method of reasoning, which had once occupied the universal attention of the learned, he dedicated the rest of his time to the delivery of a system of Rhetoric and Belles Lettres. The best method of explaining and illustrating the various powers of the human mind, the most useful part of metaphysics, arises from an examination of the several ways of communicating our thoughts by speech, and from an attention to the principles of those literary compositions, which contribute to persuasion or entertainment. The first part of these lectures, in point of composition, was highly finished; and the whole discovered strong marks of taste and original genius. His course of lectures on moral philosophy was divided into four parts. The first contained natural theology, in which he considered the proofs of the being and attributes of God, and those principles of the human mind on which religion is founded. The second comprehended ethics strictly so called; in the third part, he treated at more length of that branch of morality which relates to *justice*. Upon this subject he endeavoured to trace the gradual progress of jurisprudence, both public and private, from the rudest to the most refined ages, and to point out the effects of those arts, which contribute to subsistence, and to the accumulation of property, in producing corresponding improvements in law and government. In the last part of his lectures, he examined those political regulations, founded not upon the principle of justice, but of expediency, and which are calculated to increase the riches, the power, and the prosperity of a state: under this view he considered the political institutions relating to commerce, to finances to ecclesiastical and military establishments. In delivering his lectures, he trusted almost entirely to extemporary elocution. His manner was plain and unaffected, and as he seemed to be always interested in his subject, he never failed to interest his hearers. Each discourse consisted of several distinct propositions, which he endeavoured to prove and illustrate. In his attempts to explain them, he often appeared at first not to be sufficiently possessed of the subject, and spoke with some hesitation: as he advanced, the matter seemed to crowd upon him, his manner became warm and animated, and his expression easy and fluent. In points of controversy, it was discernible that he conceived an opposition to be made to his opinions, and that he was led to support them with greater energy and vehemence. By the fulness and variety of his illustrations the subject swelled in his hands, and acquired a dimension, which, without a repetition of the same views, was calculated to seize the attention of his audience, and to afford them pleasure and instruction in following the same object through all the diversity

of shades and aspects in which it was presented, and afterwards in tracing it backwards to that original proposition or general truth from which this beautiful train of speculation had proceeded. His reputation as a professor was raised very high; and a multitude of students from a great distance resorted to the University merely upon his account. Those branches of science which he taught became fashionable at this place, and his opinions were the chief topics of discussion in clubs and literary societies. Even the peculiarities in his pronunciation, or manner of speaking, became frequently the objects of imitation."

In the year 1755, a few of the eminent men then at the head of literature in Scotland had established a journal under the title of the "Edinburgh Review;" a title rendered familiar to the readers of the present day by the celebrity of the literary periodical journal under that name, which was established in the same city about half a century later. All that we learn of the plan and object of this design must be gathered from the only two numbers which were published of it. Smith, as is now well known, was a contributor, and, amongst other papers, was the author of the "Review of Dr. Johnson's Dictionary," then recently published, and of a very interesting letter addressed to the Editor, on the state of literature on the Continent, especially that of France. To the curious in literary relics, even these papers will be valuable, as appertaining to so celebrated a man, and the first of the productions of his genius which were committed to the public. In other respects it is perhaps unnecessary to say, that they can add nothing to the fame of the writer. Dr. Robertson was also a contributor; Mr. Hume was not; and we are indebted to Mr. Mackenzie for an amusing anecdote accounting for the omission. Such, we are told, was the extreme artlessness of his character, that his friends feared from it the discovery of their secret;—as they also feared that their criticisms would be disarmed of all their force, from the extreme gentleness of his nature, which could not tolerate even the exercise of literary warfare. The Review immediately on its appearance had attracted, as might have been expected, considerable notice; and Mr. Hume was often expressing his astonishment amongst his friends, that a production of so much talent should be going forward in the city in which he lived, and that he, connected as he was with every literary character of any distinction in it, should know nothing of its authors. It was determined at length that the secret should be communicated to him on a certain day, which was to be agreed upon, provided he would swear to preserve it. The day was fixed,—it was at a dinner where they were all expected to meet; the Review was mentioned;—Hume expressed, as he had done before, his surprise and curiosity on the subject, when he was told by one of the company, that provided he would take his oath not to divulge it, the secret should be communicated to him. "But how is the oath to be administered," said David, with his usual pleasantry, "to a man accused of so much scepticism as I am? you would not take my Bible oath, but I will swear by the το καλον, and the το πρεπον *, never to reveal your secret." Unfortunately, either from want of perseverance in those connected with it, or of encouragement in the public to any undertaking of the kind, the Review was shortly after abandoned, and the distinguished partisan whom they had thus enlisted, had no opportunity of rendering his service in its support.

The Select Society, which we have before mentioned, was another association of which Smith was a member; formed for the purpose of philosophical inquiry, and the cultivation of the art of public speaking. It met for the first time in the Advocates' Library in May 1754, and ever after during the sitting of the Court of Session, every Friday evening. The most distinguished in the Society as speakers were Sir Gilbert Elliot, Lord Elibank, and Dr. Robertson. "David Hume and Adam Smith," says the memorial, "never opened their lips;" an intimation which may occasion some surprise, when it is considered that the two men thus remarked for being mute, were, unquestionably, the most original and profound thinkers in the whole of that gifted assemblage, as well as the most elegant, and (in Mr. Hume's case) the most fluent of writers, and possessing withal ample extent and variety of learning and knowledge. But however able and distinguished in the chair of moral philosophy at Glasgow, and whatever talents he was known to possess in the circle of his friends, it

* The beautiful and the fitting.

was not until the year 1759 that Dr. Smith gave evidence to the world of those talents, and laid the foundation of his fame, by the publicacation of his first great work, the "Theory of Moral Sentiments," in which he may be supposed to embody the result of a part of his professional labours in the University upon one of the most interesting problems in the whole range of philosophical inquiry.

There are few things more pleasing with respect to a character or a composition of established genius, when we contemplate them at a distance, than to ascertain what were the opinions entertained of them by their contemporaries. Fortunately we possess the most satisfactory and delightful of all evidence upon this subject concerning the work before us; but before we enter upon any remarks on this beautiful production, we shall present our readers with a letter from Mr. Hume, addressed to Dr. Smith, immediately after its publication. It would be an injury to withhold this effusion of friendship, which possesses the highest claim upon our attention, from its connexion with one of the most important epochs in the life of the eminent person of whom we are writing. Mr. Hume happened to be in London during the publication of the "Theory of Moral Sentiments," mixing in society most distinguished for rank, taste, and learning, and always anxious, with the generosity and affection which characterized him, to extend the fame and glory of his friend. If the work had been lost to the world, and we had possessed no other evidence of its merits, and of the admiration excited by its appearance, we might form a tolerable estimate of both from the contents of the following letter:—

"*London, April* 12*th*, 1759.

"MY DEAR SMITH,

"I give you thanks for the agreeable present of your 'Theory.' Wedderburn and I made presents of our copies to such of our acquaintances as we thought good judges and proper to spread the reputation of the book. I sent one to the Duke of Argyle, to Lord Lyttleton, Horace Walpole, Soame Jennyns, and Burke, an Irish gentleman who lately wrote a very pretty treatise on the Sublime. Millar desired my permission to send one in your name to Dr. Warburton. I have delayed writing to you, till I could tell you something of the success of the book, and could prognosticate with some probability, whether it should be finally damned to oblivion, or be registered in the temple of immortality. Though it has been published only a few weeks, I think there appear already such strong symptoms that I can almost venture to foretel its fate. In short, it is this —— But I have been interrupted by a foolish impertinent visit of one who has lately come from Scotland. He tells me that the University of Glasgow intend to declare Rouet's office vacant upon his going abroad with Lord Hope. I question not but you will have our friend Ferguson in your eye, in case another project for procuring him a place in the University of Edinburgh should fail. Ferguson has very much polished and improved his treatise on 'Refinement,'* and with some amendments it will make an admirable book, and discovers an elegant and a singular genius. The 'Epigoniad' I hope will do, but it will be somewhat up-hill work. As I doubt not but you consult the reviews sometimes, at present, you will see in the 'Critical Review' a letter upon that poem, and I desire you to employ your conjectures in finding out the author—let me see a sample of your skill in knowing hands, by guessing at the person. I am afraid of Lord Kames's 'Law Tracts;' a man might as well think of making a fine sauce by a mixture of wormwood and aloes, as an agreeable composition by joining metaphysics and Scotch law. However, the book I believe has merit, though few people will take the pains of diving into it.—But to return to your book, and its success in this town, I must tell you —— A plague of interruptions! I ordered myself to be denied, and yet here is one that has broken in upon me again. He is a man of letters, and we have had a good deal of literary conversation. You told me that you were curious of literary anecdotes; and therefore I shall inform you of a few that have come to my knowledge. I believe I have mentioned to you already Helvetius's book 'De l'Esprit.' It is worth your reading, not for its philosophy, which I do not highly value, but for its agreeable composition†. I had a letter from him a few

* The same which he afterwards published under the title of "An Essay on the History of Civil Society."

† This passage is of itself tolerably conclusive as to the vulgar error of confounding Mr. Hume's philosophy with that of the French materialists of the last century and their English disciples in this.—Vide page 10, and note, p. 13.

days ago, wherein he tells me that my name was much oftener in the manuscript, but that the censor of books at Paris obliged him to strike it out. Voltaire has lately published a small work called 'Candide, ou l'Optimisme.' I shall give you a detail of it. But what is all this to my book? say you. My dear Mr. Smith, have patience; compose yourself to tranquillity: shew yourself a philosopher in practice as well as profession: think on the emptiness and rashness and futility of the common judgments of men; how little they are regulated by reason in any subject, much more in philosophical subjects, which so far exceed the comprehension of the vulgar.

> —— Non si quid turbida Roma
> Elevet, accedas: examenve improbum in illa
> Castiges trutina: nec te quæsiveris extra.

A wise man's kingdom is his own breast; or if he ever looks farther it will only be to the judgment of a select few who are free from prejudice, and capable of examining his work. Nothing indeed can be a stronger presumption of falsehood than the approbation of the multitude; and Phocion, you know, always suspected himself of some blunder when he was attended with the applauses of the populace. Supposing, therefore, that you have duly prepared yourself for the worst of all these reflections, I proceed to tell you the melancholy news, that your book has been very unfortunate; for the public seem disposed to applaud it extremely. It was looked for by the foolish people with some impatience, and the mob of literati are beginning already to be very loud in its praises. Three bishops called yesterday at Millar's shop, in order to buy copies, and to ask questions about the author. The Bishop of Peterborough said he had passed the evening in a company where he heard it extolled above all books in the world. The Duke of Argyle is more decisive than he uses to be in its favour; I suppose he either considers it as an exotic, or thinks the author will be serviceable to him in the Glasgow elections. Lord Lyttleton says that Robertson, and Smith, and Bower, are the glories of English literature. Oswald protests he does not know whether he has reaped more instruction or entertainment from it. But you may easily judge what reliance can be put on his judgment, who has been engaged all his life in public business, and who never sees any faults in his friends. Millar exults and brags that two-thirds of the edition are already sold, and that he is now sure of success. You see what a son of earth that is, to value books only by the profit they may bring him;—in that view I believe it may prove a very good book.

"Charles Townsend, who passes for the cleverest fellow in England, is so taken with the performance, that he said to Oswald, he would put the Duke of Buccleugh under the author's care, and would make it worth his while to accept of that charge. As soon as I heard this, I called on him twice, with a view of talking with him about the matter, and of convincing him of the propriety of sending that young nobleman to Glasgow; for I could not hope that he could offer you any terms which would tempt you to renounce your professorship: but I missed him. Mr. Townsend passes for being a little uncertain in his resolutions; so perhaps you need not build much on this sally.

"In recompense for so many mortifying things, which nothing but truth could have extorted from me, and which I could easily have multiplied to a greater number, I doubt not but you are so good a Christian as to return good for evil, and to flatter my vanity by telling me that all the godly in Scotland abuse me for my account of John Knox and the Reformation. I suppose you are glad to see my paper end, and that I am obliged to conclude with

"Your humble servant,
"DAVID HUME."

### SECTION 3.—*The "Theory of Moral Sentiments.*"

THE question which Dr. Smith undertook to investigate in the "Theory of Moral Sentiments," however little regarded in later times, had evidently attracted a very considerable share of attention in the early part of the last century. At the period when he applied himself to that investigation, it had been previously illustrated by some of the most ingenious and profound writers in our language. The inquiry into the nature and origin of virtue, had been treated of by the elegant and sublime Lord Shaftesbury, the logical and acute Bishop Butler, the eloquent and ingenious Dr. Hutcheson, and by Mr. Hume himself, in his celebrated treatise entitled "An Inquiry concerning the Principles of Morals."

If it be true, as Mr. Stewart has

said, and as Smith himself always declared, that he owed more to the "Political discourses" of Mr. Hume, in the "Wealth of Nations," than to any other work which had appeared prior to his time, it cannot be doubted that in the work before us he was as much indebted to the principles unfolded in Mr. Hume's "Inquiry." In their results, the difference seems only to be this;—that, whereas Hume had resolved our moral perceptions into a general and social affection, Smith had taken pains to trace them, in all cases, to an immediate sympathy with the individual acting or acted upon. Upon nearly all collateral and fundamental points they were perfectly agreed. They were equally decided in considering the question in the outset as one of fact, to be determined by the invariable nature and recorded sentiments of mankind in all ages—not as one in which it is competent to philosophers to establish a standard of virtue, as was attempted by Cudworth and Clarke, without reference to those sentiments, upon some preconceived dogma of immutable right, and the eternal fitness of things; or upon any deduction of a remote and contingent utility, according to the system of Paley and Godwin, and others of the same school. Mr. Hume had dismissed, with the contempt it deserved, the doctrine of those who had denied the reality of any distinction in morals. He had shewn by the most unanswerable reasoning that their origin was to be found in sentiment, not in the subtleties of abstract ratiocination; and has overthrown for ever, in the opinion of all who are capable of reasoning on such subjects, the selfish system of ethics, revived by Hobbes in the seventeenth century, who had borrowed it from the school of Epicurus, and who bequeathed it as a theme of everlasting cavil and epigrammatic paradox to that of Helvetius and Rochefoucauld, and their followers, in later days. Dr. Smith, though he makes little direct reference to this system founded on the absolute selfishness of man, may be considered as having stated and pronounced upon the question in the opening passage of his work:—"How selfish soever man may be supposed," says he, "there are evidently some principles in his nature which interest him in the fortune of others, and render their happiness necessary to him, though he derives nothing from it except the pleasure of seeing it; of this kind is pity or compassion, words appropriated to signify our fellow feeling with the sorrow of others." "Sympathy," he adds, "though its meaning was originally the same, may now, however, be made use of to denote our fellow feeling with any passion whatever." And upon this principle he erects his system.

It is not our intention, nor is it, indeed, within the limits of the present memoir, to attempt an analysis of this very beautiful production. A brief outline of the leading principles on which it rests may be stated as follows:—

Upon our disposition to sympathize with the passions and actions of other men, is founded our sense of propriety or impropriety—upon that of sympathizing with the motives which excite or produce those actions and passions, is founded our sense of merit or demerit; the disposition which prompts us to gratitude or resentment, to reward or to punish the agent. An application of the sentiments thus acquired by observation of the actions and character of others, to the affections and conduct of ourselves in the various relations of life in which we are called upon to act, to judge, or to suffer, gives rise to a new perception; namely, the sense of duty, the natural and final result of the joint operation of those faculties of the heart and the understanding, with which man was endowed by his Maker, and not a factitious principle of expediency, which it was left for him to deduce from the remote and contingent consequences of the actions themselves.

Of the questions which are discussed in the science of morals, the two principal are these:—What is the characteristic property of virtue or merit? And by what faculty or power are we made cognizant of its existence? In Hume's Inquiry upon this interesting subject, he involved the solution of the second question in investigating the first. Smith seems to have pursued a different course, and to have blended the first question in his discussion of the second. We have always considered that the scope of Mr. Hume's reasoning upon this point has been strangely misconceived. In shewing, as he did conclusively to our minds, that utility was an invariable attribute of all virtue, his argument was limited, and he obviously meant it to be limited to the simple establishment of the *fact;* to proving, that by the constitution of man, and the natural economy of his

moral sentiments, there was no disposition of the mind, no action attended with the general approbation of mankind, which would not be found in its results beneficial to the species. He proved that nature had so constituted us, that by an involuntary sympathy we are formed to approve of these qualities even when we can have no personal interest in the case—nay, even when our personal interest may be opposed to the exercise of them. The sentiment or emotion thus excited, is the effect of a beneficent wisdom in the moral economy of man; an economy which proves the divine origin and government of the world even more cogently than the most exquisite of the merely physical arrangements so often adduced for the purpose. But having shewn this to be the fact, it never could be intended, by that accurate and profound thinker, to draw or to suggest the inference, that in pursuit of any imagined utility, any distant and general advantage which might present itself to his narrow capacity, it was competent for man to tamper with the order of God, and in neglect of the active impulses, the affections, and even the prejudices of his nature, which, by the direction of his wisdom, were made subservient to the most admirable ends—to erect a new *standard* of morals, and pretend to shew that that mode of action might be *expedient*, which his heart told him could never be *right*. But whatever doubts may exist as to the meaning of Hume, there can be none with regard to that of Dr. Smith upon this vital question; and it is in the admirable and really philosophical spirit which pervades and animates every part of his system, and this more especially, that we conceive the great excellence of his work to consist; for it may assuredly be said of it, that if it does not furnish the true "Theory of Moral Sentiments," there can be no hesitation in admitting that its author has, at least, pointed out the way in which that theory must be sought. Smith saw, and strictly adhered to the distinction, as Mr. Stewart has well remarked*, which has been too little adverted to by ethical inquirers—the distinction betwixt the final and the efficient cause in all our moral determinations. The chapter in which this fundamental point is more directly enforced must be considered as one of the finest portions of his book, exhibiting a specimen, perhaps, of the most refined and philosophical disquisition which human language has ever embodied. It lies so directly in our way, in the few observations we think it necessary to make upon this production of Dr. Smith;—it lies so much at the root of the main difficulty involved in the inquiry concerning the foundation of morals; the most interesting problem, perhaps, in metaphysics; it comes so strongly recommended in consequence to all who can take any interest in such discussions,—that we shall cite a part of it in this place, happy if, by accident, we should be the means in this way of introducing one of our readers to an acquaintance with the work in which it is to be found.

After having traced the growth of the emotions which arise from the spectacle of vice as well as of virtue, and having shewn that the resentment which we feel in the one case is the counterpart of the gratitude we feel in the other; and that it is this emotion which, constituting our immediate sense of demerit, prompts us to inflict the punishment which the well-being of society requires should be inflicted; and that the Author of Nature did not leave it to the slow and uncertain deductions of our reason to find out the means of attaining this end, but endowed us with an instinctive feeling of approbation of the very application most proper to attain it,—he proceeds to consider the "utility of this constitution of nature." "In every part of the universe," he says*, "we observe means adjusted with the nicest artifice to the end which they are intended to produce; and in the mechanism of a plant or animal body, admire how everything is contrived for advancing the two great purposes of nature, the support of the individual, and the propagation of the species. But in these, and in all such objects, we still distinguish the efficient from the final cause of their several motions and organizations. The digestion of the food, the circulation of the blood, and the secretion of the several juices which are drawn from it, are operations all of them necessary for the great purposes of animal life; yet we never endeavour to account for them from those purposes as from their efficient causes, nor imagine that the blood circulates, or that the food

* Philos. Hum. Mind, vol. ii.

* Theory of Moral Sent. vol. i. part ii. sect. 2.

digests of its own accord, and with a view or intention to the purposes of circulation or digestion. The wheels of the watch are all admirably adjusted to the end for which it was made—the pointing of the hour: all their various motions conspire, in the nicest manner, to produce this effect. If they were endowed with a desire and intention to produce it, they could not do it better: yet we never ascribe any such desire or intention to them, but to the watchmaker; and we know that they are put into motion by a spring which intends the effect it produces as little as they do. But though, in accounting for the operation of bodies, we never fail to distinguish in this manner the efficient from the final cause,—in accounting for those of the mind, we are very apt to confound these two different things with one another. When by natural principles we are led to advance those ends which a refined and enlightened reason would recommend to us, we are very apt to impute to that reason, as to their efficient cause, the sentiments and actions by which we advance those ends, and to imagine that to be the wisdom of man, which is in reality the wisdom of God. Upon a superficial view, this cause seems sufficient to produce the effects which are ascribed to it, and the system of human nature seems to be more simple and agreeable when all its different operations are in this manner deduced from a single principle." After distinguishing in this way the efficient from the final cause of our moral impressions, our first perceptions of right and wrong,—after shewing that though it is absolutely necessary for the subsistence of society that the laws of justice should be observed, yet that it is not from a consideration of this necessity that we originally approve of their enforcement (though he admits that our regard for them may often be confirmed, and may sometimes require to be confirmed by such consideration),—he proceeds, "We frequently hear the young and the licentious ridiculing the most sacred rules of morality, and professing, sometimes from the corruption, but more frequently from the vanity of their hearts, the most abominable maxims of conduct. Our indignation rouses, and we are eager to refute and expose such detestable principles. But, though it is their intrinsic hatefulness and detestableness which originally inflame us against them, we are unwilling to assign this as the sole reason why we condemn them, or to pretend that it is merely because we ourselves hate and detest them. The reason, we think, would not appear to be conclusive. Yet why should it not; if we hate and detest them, because they are the natural and proper objects of hatred and detestation? But when we are asked, why we should not act in such or such a manner, the very question seems to suppose, that to those who ask it this manner of acting does not appear to be for its own sake the natural and proper object of these sentiments. We must shew therefore, that it ought to be so for the sake of something else; and the consideration which first occurs to us is the disorder and confusion of society which would result from the universal prevalence of such practices. We seldom fail therefore to insist upon this topic. That it is not a regard, however, to the preservation of society, which originally interests us in the punishment of crimes committed against individuals, may be demonstrated by many obvious considerations. All men, even the most stupid and unthinking, abhor perfidy and injustice, and delight to see them punished. But few men have reflected upon the necessity of justice to the existence of society, however obvious that necessity may appear. The concern which we take in the fortune and happiness of individuals does not, in common cases, arise from that which we take in the fortune and happiness of society. We are no more concerned for the destruction or loss of a single man, because the man is a member or part of society, and because we should be concerned for the destruction of society, than we are concerned for the loss of a single guinea, because this guinea is part of a thousand guineas, and because we should be concerned for the loss of the whole sum. In neither case does our regard for the individuals arise from our regard for the multitude; but in both cases our regard for the multitude is compounded, and made up of the particular regards which we feel for the different individuals of which it is composed. As when a small sum is unjustly taken from us, we do not so much prosecute the injury from a regard to the preservation of our whole fortune as from a regard to that particular sum which we have lost; so when a single man is injured or destroyed, we demand the punishment of the wrong that has been done to him, not so much from a

concern for the general interest of society, as from a concern for that very individual who has been injured."

In a subsequent part of his work, wherein he treats of the "Influence of fortune upon our Moral Sentiments," and shews that, though it is the intention or affection of the heart, the propriety or impropriety, the beneficence or hurtfulness of the design that all praise or blame which can be bestowed upon an action must ultimately belong; yet, nevertheless, the result of those actions, the actual consequences which often proceed from them, do materially affect our sentiments:—He traces, in the same admirable spirit, the final cause of this inconsistency in our judgments; and remarks that—"that necessary rule of justice, that men in this life are accountable for their actions only, not for their designs or intentions, is founded upon this salutary and useful irregularity in human sentiments concerning merit and demerit, which appears at first sight so absurd and unaccountable. But," he concludes, "every part of nature, when attentively surveyed, equally demonstrates the providential care of its Author; and we may admire the wisdom and the goodness of God even in the weakness and the folly of men."

We have the greater pleasure in citing these passages, because we think that we may read in them the best refutation of that theory of expediency, which nothing but the reputation of Dr. Paley could ever have recommended to the world*—a theory which Mr. Stewart has characterised in a strain of indignant eloquence, that well became him on such a topic, as one which, "absolving men from the obligations imposed upon them by the moral constitution of human nature, abandons every individual to the guidance of his own narrow views concerning the complicated interests of society†."

It may not perhaps be unworthy of observation, before we close these few remarks upon the "Theory of Moral Sentiments," that the same principle of sympathy as a source of morals, from which Smith has deduced his system, appears to have been referred to by Polybius, in a remarkable passage of his history, for the same purpose. It is rather long for a quotation; but as it is curious in itself, and as Polybius is not a writer in every one's hands, we shall transcribe part of it in a note below; when possibly it may appear, after all, that the coincidence is rather in expression than in substance, and that it applies rather more strikingly to the doctrine of *sympathy with utility*, (the theory of Hume) than to that of sympathy as unfolded by Smith*.

## SECTION 4.—*From the publication of the "Theory of Moral Sentiments" to that of the "Wealth of Nations."*

WE have seen, from the letter which Mr. Hume addressed to our author, something of the impression which was produced by the publication of his first great work. We shall shortly perceive that the hope therein expressed, that it might lead to an interesting connexion with the Duke of Buccleugh was not idly formed. In the meantime, however, it made no change in the life and habits of Dr. Smith. He continued his professorship in the University of Glasgow for a period of four years after this, directing his attention, and that of his students, somewhat less to that department of ethics, of which he had presented to the world his views, and treating more particularly of the subjects which come within the range of jurisprudence, and political philosophy. Of the long and profound attention he had devoted to this latter branch of moral science, he has bequeathed an imperishable monument to the world in

* It may be allowed us to state in a few words what we have always considered to be the wide difference upon this great point, betwixt the doctrine of Mr. Hume and that of Dr. Paley, which it is surprising to see so often confounded. Hume proved from the phenomena of human nature as a *fact*, that whatever in moral conduct was intrinsically right, was useful. Paley laid it down as a *rule*, that whatever was expedient, was right; and thus converted a position of undeniable truth and beauty into an hypothesis full of fallacy, as the solution of a problem pregnant with evil in its consequences, when considered as a precept.

† Philos. Hum. Mind, vol. ii. Ch. 4, Sect. 6.

* "For man, who among all the various kinds of animals is alone endowed with the faculty of reason, cannot, like the rest, pass over such actions (ingratitude and injustice) with indifference; but reflecting on what he sees, and comparing the future with the present, will not fail to express his indignation at this injurious treatment, to which, as he foresees, he may at some time be exposed. Thus it is certain that all men must be shocked by such ingratitude through sympathy with the resentment of their neighbour, and from an apprehension also that the case may be their own. And from hence arises in the mind of man, a certain sense of the nature, and force of duty, in which consists both the beginning and the end of justice; and thus it is that the people begin to discern the nature of things, honourable or base, and in what consists the difference between them; and to perceive that the former, on account of the advantage that attends them, are fit to be admired and imitated, and the latter to be detested and avoided."—*Polybius*, Hist., Book vi. Ex. 1, Ch. i. Hampton's Translation.

his "Wealth of Nations." His views upon the theory of jurisprudence, except inasmuch as he has embodied some of its important principles in that work, were confined to his lectures; though it is clear from an intimation conveyed in the closing paragraph of the "Moral Sentiments," and still more so from the advertisement he prefixed to the last edition of that work, written only a few months before his death, that it was a subject which, during the whole of his life, he had deeply meditated, and upon which he had always designed to communicate his labours to the public, if the engagements with which he was occupied during the latter period of it had not interfered to prevent him.

For himself, Dr. Smith has undoubtedly done enough, and so far as regards his own interest and his fame, it would be idle to indulge in regrets. For the world however, and for the interests of science, perhaps a greater loss has been rarely sustained than in the unfortunate circumstances, whatever they were, which concurred to deprive it of this most valuable portion of his labours. The enlarged views he had evidently formed of the objects and principles of legislation; the glimpses which we occasionally catch in his other writings of the spirit in which he was accustomed to contemplate such subjects; the pure and lofty sources to which he was accustomed to refer for those principles; all assure us of the invaluable addition which would have been made to this department of philosophy, had it been illustrated by his pen.

From this, however, and from his academical labours generally, he was withdrawn in the year 1763, by an invitation to accompany the Duke of Buccleugh on his travels; an appointment which was principally recommended to him at the time, by the desire which he had conceived of visiting the continent. The proposal, which was made to him through Mr. Charles Townsend, was liberal in the extreme; as might be expected to be made to such a man, to induce him to quit the scene of his honourable and useful labours, the society of his friends, and those studious delights, known only to the pure and devoted lovers of truth, which constitute the highest charm of human existence.

It is well known that, whatever pleasure Smith might derive from his tour, or whatever advantage from his connexion with the noble family of Buccleugh, the separation from the university of Glasgow was a source to him of very heartfelt regret. An interesting and characteristic anecdote has been recorded of him, relative to his resignation of his duty as professor there, which is well worth preserving.

It was at the latter end of his course of lectures, that it became necessary for him to take his departure, and it was well ascertained that he had been at exceeding pains to provide, in a friend, a very competent successor for that part of the course which yet remained unfinished. He had suffered the greatest possible anxiety upon this point, and had done everything that might satisfy the most scrupulous of his friends and his pupils. This, however, did not satisfy the conscientious delicacy of Dr. Smith. He was of course aware of the high estimation in which he was held in the university, and the just value which was put upon his lectures. The day at length arrived when he was to address the students of his class for the last time, and it was a moment deeply affecting to both parties. He took leave of them in a tone of affection and regret, which enlivened their mutual sorrow; and when they were about to depart, he called them severally to his chair, and tendered to each of them, carefully folded in paper, the amount of the fee which he had received for the whole course of his lectures, notwithstanding so small a portion of it only remained unfinished. This was of course refused resolutely, as by acclamation; the professor, however, persisted in his endeavour, assuring them that he should not be satisfied otherwise, and that he should quit them under the impression of having failed in his duty, and of having wronged them, if they did not take back the fee for the entire course of lectures, which circumstances prevented him from completing. It was in vain that they assured him how far they were overpaid by the smallest portion of his labour bestowed upon them for the trifling emolument he derived; how real a wrong they should be committing to consent to such a proposal, and, in short, their firm determination by no means to listen to it. The professor was sensibly touched by their generous avowal, but he was not to be moved from his purpose. When they were at last on the point of quitting the lecture-room, he seized hold of the foremost of the students, and

absolutely forced the money into his hands, exclaiming, with his accustomed ardour, " Nay, gentlemen, I will not suffer this; it is a matter of conscience with me, and I must have my way;" and in this manner seeing him so deeply concerned in his object, they were obliged to submit; and thus to terminate a struggle of very unusual occurrence, equally honourable to the delicacy and generosity of the professor, and the attachment of his pupils.

It may safely be said, without disparagement to the many eminent successors of Dr. Smith, that his removal from the chair of moral philosophy was perhaps the greatest loss which the University of Glasgow has sustained. Of his merits and his method as a lecturer, we have presented our readers with an interesting memorial in the last section; but there is a circumstance related of him which may still better serve to evince the pains and sagacity which he exerted in the performance of his duty, and may suggest a standing and instructive lesson to both public and private teachers in all times and places. It is said that in the delivery of his daily lectures, his observation had been drawn, in an especial manner, to a certain student of his class, whose general habit of close and riveted attention to what was going on, became a mark or indication to the professor of the degree in which he succeeded in the developement and expression of his subject—that he was accustomed to fix his eye upon the student in question, and as long as he found that he retained his hold of his attention, he felt satisfied; but whenever he remarked any relaxation in his manner, whether in the wandering expression of his countenance, or the position of his body, which seemed to indicate a diminishing interest in the lecture—" I took this as a valuable admonition," he used to say; " I was sure that there was something wanting either of connection in my reasoning or of sufficient fulness and perspicuity in my exposition, and I immediately paused. I recapitulated what I had been saying—I explained—I re-argued —I endeavoured further to illustrate my propositions, and I never felt quite satisfied that I was going on right, until I had regained complete hold of my monitor, till I saw by the resumption of his usual manner and gaze that I possessed the whole of his attention."

Having disengaged himself as well as he could from the ties that bound him to Glasgow, Smith quitted that city in January, 1764, and joined the Duke of Buccleugh in London, where they remained together a couple of months. In March they set out on their route to Paris, and had the fortune to be joined at Dover by Sir James Macdonald, who accompanied them as far as the French capital, where they parted;—Sir James on his way to Italy, where he died within two years after, in the twenty-fifth year of his age. Were there no other testimony to the merit of this accomplished person, it would be sufficient to shew that he enjoyed in so high a degree the esteem and admiration of two such men as Dr. Smith and Mr. Hume; and a letter which the latter addressed to Smith, on the occasion of his death, contains strong evidence of this—" Were you and I together," says he, " we should shed tears at present for the death of poor Sir James Macdonald: we could not possibly have suffered a greater loss than in that valuable young man."

It was about the same time when Smith set out for the continent with the Duke of Buccleugh, that his friend Hume had been invited to join the embassy of the Earl of Hertford at Paris. Smith remained in that city only a few days; but before he left it we should mention that he addressed the rector of the University of Glasgow in form, tendering his resignation of the chair he had filled, and expressing himself as might be expected on such an occasion. —" I was never more anxious" (he says, in the conclusion of his letter) " for the good of the college than at this moment; and I sincerely wish that, whoever is my successor, he may not only do credit to the office by his abilities, but be a comfort to the very excellent men with whom he is likely to spend his life, by the probity of his heart and the goodness of his temper." On the receipt of this letter, the chair was declared to be vacant; and at a meeting of the heads of the university the sense of the value of their late professor, and the loss sustained by his removal was recorded in the following terms:—

" The University cannot help expressing their sincere regret at the removal of Dr. Smith, whose distinguished probity and amiable qualities procured him the esteem and affection of his colleagues, and whose uncommon genius, great abilities, and extensive learning, did so much honour to this society: his

elegant and ingenious 'Theory of Moral Sentiments' having recommended him to the esteem of men of taste and literature throughout Europe. His happy talent of illustrating abstracted subjects, and faithful assiduity in communicating useful knowledge, distinguished him as a professor, and at once afforded the greatest pleasure and the most important instruction to the youth under his care."

On quitting Paris, Dr. Smith and the Duke of Buccleugh proceeded to Toulouse, where they fixed their abode for a year and a half; enjoying the best society of the place, and finding in new manners and new modes of existence fresh sources of interest and information equally advantageous to both parties—to Dr. Smith affording opportunities of extending and confirming his previous acquaintance with men and books; and perhaps having the effect of biassing his judgment in some matters of taste and literature, rather erroneously, in favour of French criticism and genius, and of certain pre-conceived theories to which he was naturally inclined.

On quitting Toulouse, they spent the autumn of that year in a tour through the southern provinces of France and to Switzerland. At Geneva they remained a couple of months; and returned to Paris about Christmas 1765, where they continued till the month of October following.

It was at Paris, as we may well suppose, that Smith, after all, enjoyed by far the highest gratification which his journey afforded him. The capital, as Mr. Hume used to say, is the true scene for a man of letters; and if any, surely it was the capital of France at this period. Mr. Hume himself was there only for a short time after the arrival of his friend; but he was there long enough to introduce him to the most distinguished philosophers and men of learning then living in Paris:—D'Alembert, Helvetius, Marmontel, Turgot, Quesnai, and many others. The society of the two latter in particular we may be assured, from the congeniality of their sentiments upon subjects which Smith was at that time deeply meditating, must have been gratifying to him in a degree not very easy to conceive. It was that private and unreserved interchange of opinion in matters of moral and political science, with men like these, equally enlightened with himself, and animated by the same zeal for the happiness of mankind, that constituted his felicity; for, in other respects, the mere gaiety and brilliancy of Parisian society were not adapted to his taste and manners; nor were his powers in conversation such as fitted him to shine amid its glare.

With Turgot and Quesnai he contracted a very close intimacy. With the former it was long supposed that he maintained an epistolary correspondence for a long period after his return to Scotland, a circumstance which excited naturally considerable interest, but of which Mr. Stewart, who took some pains to inquire into it, found reason to doubt the truth. It is certain that no memorial of such correspondence existed amongst Smith's papers, nor has any been made public from those of Turgot. It is well known, indeed, that Smith had no fondness for letter-writing, nor are we aware of three letters of his which have ever appeared in print. As he wrote few letters, it is equally to be regretted that he kept no journal during his travels, or if he did, that it was amongst the other papers which he took such anxious pains to secure the destruction of previous to his death.

Amongst the other eminent persons with whom Smith became acquainted whilst in Paris, and from whom he received distinguished marks of respect, was the family of the Duke de la Rochefoucauld; a circumstance not unworthy of being recorded, inasmuch as his introduction to that accomplished and amiable man led to the suppression in the latter edition of his "Theory of Moral Sentiments" of a rather severe animadversion upon the author of the celebrated "Maxims," which had been expressed in the first, where Smith had associated the name of Rochefoucauld with that of Mandeville. There is a letter extant from the Duke de la Rochefoucauld dated in 1778, addressed to Smith, transmitting to him a new edition of the "Maxims," in which he adverts with some pain to Dr. Smith's censure, and offers a poor apology, though the best that can be made, for a very shallow and pernicious performance, which persons equally shallow have taken for philosophy, but which nobody would have thought it worth while to remember or refute, if it had not been written in epigrams. In France he studied the principles of the economists in their writings as well as in their conversations; and was perhaps first led by the errors of that ingenious and amiable sect, to the contemplation of the more wide and just views to which

his mind was opening. The fine arts also and belles lettres, the poetry, and especially the drama of that country, subjects well worthy the contemplation of the philosopher, engaged no small share of his attention. The imagination and the arts which are addressed to it; the refined pleasures of which it is susceptible, and the taste to appreciate those pleasures, were then deemed not unworthy the attention of a philosopher. The principles upon which the arts are founded, the origin and nature of the emotions they excite, and the causes which, in different ages and nations, have diversified their character and operation, are subjects which were not only supposed to have some interest in themselves, but which have been investigated by such metaphysicians and economists as Hume and Smith, and Berkeley and Dugald Stewart, from the intimate and indissoluble connexion which they hold with the philosophy of the human mind; and as embracing an extensive and beautiful class of phenomena which form part of the great science of human nature. We are pleased to record such things in the character of Smith; because, however unimportant at other times, they are of consequence now, when one of the first of sciences is in danger of suffering in public estimation from the narrow and repulsive spirit which is occasionally mingled in its discussions: and because they shew that political economy, as a study, is not incompatible with a love of literature, and eloquence, and poetry; and assuredly not so with good taste and good writing*.

Dr. Smith's own taste in literature, as has been already hinted, was disposed to the admiration of what has been since denominated the classical, in contradistinction to the romantic, school of art. We do not remember, at this moment, a single reference to Shakspeare in the whole of his writings; while the lofty praise he has taken occasion to bestow upon the tragedies of Racine and Voltaire, his allusions to Pope, and encomium on Gray, exhibit more positive testimony in proof of this taste. But reserving what we have further to say respecting his general intellectual character and literary taste, for the conclusion of our memoir, we proceed to detail the few remaining incidents of his life.

In October, 1766, Dr. Smith returned to London, where he and the Duke of Buccleugh separated; after having spent three years together, without the slightest coolness or disagreement; and, "on my part," says the Duke, in a letter which he addressed to Mr. Stewart, "with every advantage that could be expected from the society of such a man. We lived in friendship till the hour of his death; and I shall always retain the impression of having lost a friend whom I loved and respected, not only for his great talents, but for every private virtue."

Shortly after his return to England, he went down to his native place, where he continued to reside almost uninterruptedly for the next ten years of his life. An occasional visit to his friends at Edinburgh, with a journey to London once or twice in the interval, were his only diversions from a course of intense application. To his friends, to Mr. Hume in particular, this severe seclusion was a frequent matter of regret and complaint. Hume had returned to Edinburgh in 1669, after quitting his engagement with Lord Hertford; and in a letter written shortly after to Smith, he says, (dating from his house in St. James' Court, which commanded a prospect of the Forth and the opposite coast of Fife)—"I am glad to have come within sight of you; but as I would also be within speaking terms of you, I wish we could concert measures for that purpose. I am mortally sick at sea, and regard with horror and a kind of hydrophobia the great gulph that lies between us. I am also tired of travelling, as much as you ought naturally to be of staying at home; I therefore propose to you to come hither, and pass some days with me in this solitude. I want to know what you have been doing, and propose to exact a rigorous account of the method in which you have employed yourself during your retreat. I am positive you are in the wrong in many of your speculations, especially where you have the misfortune to differ from me. All these are reasons for our meeting, and I wish you would make me some reasonable proposal for that purpose. There is no habitation in the island of Inchkeith, otherwise I should challenge you to meet me there, and neither of us ever to leave the place till we are fully

* It is but justice to say here, that we are most happy to except from any censure implied in the above observations, two distinguished professsors of political economy—we mean, Mr. Senior of Oxford, and Mr. Macculloch of the University of London—both of whom have invariably written and spoken in the spirit of their great master.

agreed on all points of controversy. I expect General Conway here to-morrow, whom I shall attend to Roseneath, and I shall remain there a few days. On my return, I hope to find a letter from you, containing a bold acceptance of this defiance."

There are extant several letters from this celebrated person, in which he exhorts his friend to leave his retirement, in terms expressive at once of the fondest friendship, and the most longing desire for his society: "I shall not take any excuse from your state of health," he writes on another occasion, "which I suppose only a subterfuge invented by indolence and love of solitude. Indeed, my dear Smith, if you continue to hearken to complaints of this nature, you will cut yourself out entirely from human society, to the great loss of both parties."

During the whole of this period, Smith may be considered as engaged in the composition of his great work. The room is still shewn at Kirkaldy, in which was written the greater part of the "Wealth of Nations;" and to that, and to scenes ennobled in like manner, by the exertions of genius and learning, will mankind some day make their pilgrimage in devotion to science and to virtue, when the shrines of kings and conquerors shall attract the homage which is often paid to them as little as they deserve it.

In the spring of the year 1773, he went up to London for rather a longer period than he was in the habit of leaving home; partly for the purpose of collecting some information, and making references relative to the work which now engrossed his whole thoughts.

There are so few letters of Smith's extant, as we have before observed, that we shall not hesitate to present to our readers the following, which he addressed to Mr. Hume on the point of his departure, as it serves to shew the extreme anxiety which he always felt about the destruction of his manuscripts:—

"*Edinburgh, April* 16*th*, 1773.

"MY DEAR FRIEND,

"As I have left the care of all my literary papers to you, I must tell you, that, except those which I carry along with me, there are none worth the publication but a fragment of a great work, which contains a history of the astronomical systems that were successively in fashion down to the time of Des Cartes. Whether that might not be published as a fragment of an intended juvenile work, I leave to your judgment; though I begin to suspect that there is more refinement than solidity in some parts of it. This little work you will find in a thin folio paper in my back room. All the other loose papers, which you will find in that desk, or within the glass folding doors of a bureau in my bedroom, together with about eighteen thin folio books, which you will likewise find within the same glass folding-doors, I desire may be destroyed without any examination. Unless I die very suddenly, I shall take care that the papers I carry with me shall be sent to you.

"I am ever, my dear Friend,

"Most faithfully yours,

"ADAM SMITH."

The memorable year 1776 was now approaching, memorable in the life of Smith, as it was in the spring of that year that he gave to the world his immortal work, the "Inquiry into the Nature and Causes of the Wealth of Nations," and in the autumn that death deprived him of his immortal friend, Mr. Hume.

Smith was in London at the time of the publication of his book; and the highest gratification, perhaps, afforded him on that occasion—higher, perhaps, than any which the praises of the world could give—was conveyed to him in the following letter, addressed to him by his dying friend. It was written from Edinburgh, only a few days before he set out on his journey to the South, as the only remaining hope of preserving his life; and testifies, almost in his last moments, the same amiable solicitude for his friends and their fame which characterised him throughout the whole of his existence. The letter is dated April 1, 1776—"Euge Belle! Dear Mr. Smith—I am much pleased with your performance, and the perusal of it has taken me from a state of great anxiety. It was a work of so much expectation by yourself, by your friends and by the public, that I trembled for its appearance, but am now much relieved. Not but that the reading of it necessarily requires so much attention, and the public is disposed to give so little, that I shall still doubt for some time of its being at first very popular. But it has depth, and solidity, and acuteness, and is so much illustrated by curious facts, that it must at last take the public attention. It is probably much improved by your last

abode in London. If you were here, at my fireside, I should dispute some of your principles. But these, and a hundred other points, are fit only to be discussed in conversation. I hope it will be soon, for I am in a very bad state of health, and cannot afford a long delay."

It was but a few months after the publication of "The Wealth of Nations," when the death of Mr. Hume gave occasion to one of the most memorable and honourable incidents in the life of Smith. Attached as they had been for years, by ties of no ordinary kind; revering and loving the friend of his life, for moral and intellectual qualities, rarely found apart, and still more rarely united, congenial in their sentiments upon every subject perhaps, save one—a difference upon which could create no abatement in the affections of two such men—Smith felt himself called upon, his heart yet bleeding under the loss he had sustained, to defend from calumny, now that he was dead, him, whom while living she had "never touched or attacked with her baleful tooth."*

It is well known that, from the nature of some of Mr. Hume's speculative opinions, coupled with the high celebrity of his name, his death had attracted no small degree of attention. It is known, too, that far more of zeal than charity had been displayed in a variety of rumours, equally false and absurd, which had been circulated relative to that melancholy event—calumny which, as we have said, had watched her hour, now poured forth her venom; and stories of death-bed horror and remorse, and agony and confession, were current through the land. It was easy to smile at all this; but it was felt to be due to the virtues of the man—to the benevolence of his affections and the unsullied purity of his life, to state the simple fact, that Mr. Hume's deathbed had betrayed no remorse whatever. Smith undertook to do this, undeterred by the obvious risk of incurring the odium of sharing the opinions of his friend, on the only subject perhaps on which they differed.

A few months only previous to his death, Mr. Hume had drawn up that brief but characteristic memorial of himself, entitled "My Own Life," and had left the care of its publication to Dr. Smith. To this memoir Smith appended his celebrated letter addressed to Mr. Strahan, for the purpose, as he says, "of giving some account of the behaviour of their excellent friend during his last illness." The letter commences, therefore, where Hume's own account had ended; and having described the unruffled serenity of his mind and temper throughout the whole of his rapid decline—"his cheerfulness so great that his friends could not regard him as a dying man"—even to the last hour "so free from the smallest anxiety or low spirits that he never dropped the smallest expression of impatience, but when he had occasion to speak to those about him, doing it with the utmost affection and tenderness," and "that he died in such a happy composure of mind that nothing could exceed it."—He closes with the following passage, which we hesitate not to transcribe in this short memorial, (as we should have done the entire letter if our limits would admit,) because it is a greater honour to the writer than the subject; and because it is quite certain, that if there is one page from the pen of Smith that he would himself have desired to perpetuate, it this tribute to his friend, although it may be suspected that the warmth of friendship has somewhat overcharged the eulogy:—"Thus died," says he, "our most excellent and never to be forgotten friend, concerning whose philosophical opinions men will, no doubt, judge variously; every one approving or condemning them according as they happen to coincide or disagree with his own; but concerning whose character and conduct there can scarce be a difference of opinion. His temper, indeed, seemed to be more happily balanced, if I may be allowed such an expression, than that perhaps of any other man I have ever known. Even in the lowest state of his fortune, his great and necessary frugality never hindered him from exercising, on proper occasions, acts both of charity and generosity. It was a frugality founded not upon avarice, but upon the love of independency. The extreme gentleness of his nature never weakened either the firmness of his mind or the steadiness of his resolutions. His constant pleasantry was the genuine effusion of good nature and good humour, tempered with delicacy and modesty, and without even the slightest tincture of malignity, so frequently the disagreeable source of what is called wit in other men. It never was the meaning of his raillery to mortify, and therefore far from offend-

* Hume—"My Own Life."

ing, it seldom failed to please and delight even those who were the objects of it. To his friends, who were frequently the objects of it, there was not any one, perhaps, of all his great and amiable qualities which contributed more to endear his conversation. And that gaiety of temper, so agreeable in society, but which is so often accompanied with frivolous and superficial qualities, was in him certainly attended with the most severe application, the most extensive learning, the greatest depth of thought, and a capacity in every respect the most comprehensive. Upon the whole, I have always considered him, both in his lifetime and since his death, as approaching as nearly to the idea of a perfectly wise and virtuous man, as perhaps the nature of human frailty will permit."

The effect of such a testimony, from such a quarter, was to put to silence, and it is to be hoped, in a great measure to put to shame, the disgraceful cry which had been set up; yet it did not do so altogether. Some there were who still joined in it, and taking advantage, as might have been foreseen, of Smith's generous zeal, attempted to heap upon the living that obloquy from which he had rescued the dead. Dr. Horne, afterwards Bishop of Norwich, published a letter addressed to Dr. Smith, in which the spirit of the theologian is much more conspicuous than that of the Christian, veiled as it was under an affectation of humour and irony, that ill concealed the bitter feelings in which it originated. To this publication of Dr. Horne, Dr. Smith did not deem it at all necessary that he should make any reply. He felt that he had done enough, and that it would have been equally unworthy of himself and his cause, to have commenced a controversy with Dr. Horne upon the merits, personal or philosophical, of David Hume.*

### Section 5.—*The "Inquiry into the Nature and Causes of the Wealth of Nations."*

It will scarcely be considered an exaggerated praise to say, that the "Wealth of Nations" may be regarded as, perhaps, the most valuable acquisition which was made to philosophy and to science in the eighteenth century. It is of course quite beyond the limits of this memoir to offer an abstract or analysis of this great work. But, as in reference to the "Theory of Moral Sentiments," it was deemed proper to say a few words upon the subject itself of which it treats, and upon the leading principle of that theory; so it may be allowed us to offer a very few observations, in the same manner, upon the "Inquiry into the Nature and Causes of the Wealth of Nations," unquestionably the greatest production of Smith's genius.

In the closing passage of the "Moral Sentiments," he had promised, in some future work, to give an account of the general principles of law and government, and of the different revolutions they have undergone in the different periods of society; not only in what concerns justice, but *in what concerns police, revenue, and arms, and whatever else is the object of law; and to trace, in this way, those invariable principles which ought to run through, and be the foundation of the laws of all nations.*

In the "Wealth of Nations" he undertook to redeem this pledge, as far as regards police, revenue, and arms, by tracing the source, and nature, and progress of national wealth.

The fundamental principle, dimly conceived indeed, but never established and insisted upon before, upon which Smith raised, as upon a rock, the Science of Political Economy, was, that *labour is the source and origin of all wealth.* "Labour," says he, "was the first price, the original purchase money that was paid for all things. It was not by gold or by silver, but by labour, that all the wealth of the world was originally purchased;" and the mode by which the labour of man can be rendered most productive to his use and happiness is the problem to be solved by the economist.

Now the great cause of the increase in the productive powers of labour is found to consist in the *division* of labour—a division which arises in the first instance from the obvious suggestions of nature, and which, by giving birth in its progress to the institution of the various

* Having acknowledged our obligation to Mr. Stewart in the opening of this Memoir, it is only right that we should observe, that for several of the incidents which will be found in in it, we are not indebted to that eminent person; and that amongst other circumstances in the very barren life of Dr. Smith, of which he has made no mention, this very remarkable one of his conduct upon the death of Hume has been passed over in silence. For this omission we can be at no loss to account: it was dictated by the amiable solicitude for his friend's memory; and the apprehension that it might suffer from a revival of the asperities which his friendly zeal had excited. But a regard for truth prevents us from making a like omission.

arts, trades, and professions which exist in every advanced state of society, occasions that universal opulence which extends itself to the lowest ranks of the people.

But the effects of this principle have never in any society, or in any age of the world, been seen in their full extent, owing to the unjust and impolitic regulations which governments and legislators have at various times devised to control and thwart its operation. Instead of allowing every man to pursue his own interest in his own way, no society has ever yet been seen in which, from false views of policy, or from worse motives, extraordinary restraints have not been laid upon some branches of industry; while extraordinary privileges, equally injurious in their result, have been bestowed upon others.

In how different a spirit was conceived and executed the great work before us, is exhibited in every page. Smith aimed at, and he has succeeded in reducing that to a science, which had before been a succession of contrivances and devices, where no principle was ever referred to, and in which it was long supposed that science and principle could have no place*. The origin and continuance, indeed, of many of the most barbarous and oppressive institutions which tend to repress the energies of mankind, are to be traced very often to accidents, expedients, and prejudices, which belong as much to the people who are made to suffer from them, as to the laws and rules which have sometimes been the mere instruments of their establishment. To correct the policy of both was the object, and will be the lasting consequence, of his book. It was not by framing new forms of government, but by enlightening the policy of actual legislators, (as Mr. Stewart has well remarked,) that Dr. Smith, and other distinguished men of the last and present age, have attempted to ameliorate the condition of society. He endeavoured to shew, in one important branch of legislation, how much of the evils which affect its prosperity may be remedied by wise policy, and how much is the result of those higher and unalterable laws, by which the course of human affairs is determined, and the operation of which, since they cannot be controlled, must be patiently endured.

An illustration of this may be found in that important part of his work wherein he treats of the causes which determine the rate of wages. When the economist describes, for instance, the manner in which the value of labour is affected by the combination laws, the apprentice laws, and the law of settlement,—he explains the mischief produced in all cases by their operation; in the injury sustained under them by the labourer himself, from their evident violation of that natural liberty and justice which is his right; in the inequality which they occasion in different departments of industry, and in different places, from their interference with that essential order and prosperity which would otherwise ensue from allowing every man, as long as he observes the rules of justice, to pursue his own interest in his own way. Thus far of the inexpediency and absurdity of such arrangements with respect to society at large; and of the influence which bad regulations or injurious laws may have in affecting the condition of the labourer, and that of the community of which he forms a part. But, when he comes to explain how, under all circumstances, and in every society where even the rights of individuals are most respected by the spirit of its government and its legislation, the general rate of wages must always depend upon the relative quantity of labour seeking employment, and of capital having employment to give: that it is a law of economy, resulting from a law of nature, that where labour is superabundant in proportion to capital, there it will necessarily be cheap; or, in other words, wages will be low—and that, on the contrary, where capital accumulates rapidly, and exceeds the supply of labour in the market, there labour will be dear, or, in other words, that wages will be high—when he has deduced this vital and important truth, and suggested thereby to the labourer, that on himself must mainly depend his ultimate prosperity, and that his condition for better or for worse is determined in this way by laws with which no human legislation can interfere, except in the removal of restrictions and prohibition, the political philosopher has done more for the peace and good order of society; and more to remove the sources of ill will, and promote a right understanding of their relative

* Even the capacious mind of Mr. Fox is said to have been sceptical with regard to some of the truths unfolded by Adam Smith; and within a much more recent period, we may remember that an illustrious statesman, now no more, spoke in Parliament, of the "application of philosophy to politics" as a thing having the air of paradox, and which it required a tone of apology to refer to.

position and duties in its different members; between labourers and their employers, between subjects and their government—more than can be achieved by the force of exhortation in a hundred volumes, or the force of power in a hundred armies.

But the complete development of the principle of the division of labour, it must be borne in mind, requires that the fullest and freest scope be allowed to competition, which is, in other words, the entire freedom of commercial intercourse. What the inhabitants of the different provinces of a great kingdom are to each other by the division of their employments, and the interchange of their commodities; so are the various people of the different countries of the globe. They are all bound together by the same great law, the use and benefit which they may derive from the exercise of each other's skill, and the produce of each other's labour; and this economy of nations would be as obvious as it is in the case of a single people, if bad politics, springing out of bad passions; if ambition and the love of conquest, and the glare of military glory, which compose for the most part the history of nations, had not blinded men to their true interests, and corrupted the common sense and virtue of mankind.

To recommend this unlimited freedom of commercial intercourse; to shew how the restrictions which have been put upon it have in all cases defeated the object in view, and must continue to do so from the nature of things; to shew that the ordinary impulses we obey in pursuance of our own selfish interest, and which might seem to have no other end, are made, by the wise order of the great Author of our being to point far higher, and to be conducive in their results to the good of the society, as much as to that of the individual, or even more so, (for the advantage we plan for ourselves often escapes us, when that to society remains;) to shew, in the intercourse of nations as of men, "that *true* self love and social are the same," and that mutual wants, by the all-wise economy of Providence, were made to minister to mutual happiness;—that the instinctive desire by which every man is actuated, of improving his own condition (laws and government having no other province than that of taking care that, in pursuit of this end, he trenches not on the right of his neighbour), is the simple but solid basis on which has been reared and secured the everlasting progress of nations in every age:—Such were the enlightened doctrines which it was the purpose of Smith's work to enforce; and it is obvious that all legislation which proceeds upon an ignorance or contempt of these laws, is to the body politic, just what the prescriptions of a physician would be to the natural body, who knew nothing of the animal economy, its functions, or its structure.

As in the "Theory of Moral Sentiments," in treating of the moral constitution of man, he had been careful to distinguish the efficient from the final cause of our passions; he carried the same enlightened philosophy into all his investigations of human affairs, and shewed, as he beautifully expresses it, "that what is taken for the wisdom of man, is in reality the wisdom of God." There are numerous passages in his writings in which he inculcates the same sentiment, and enlarges on the folly of those speculators, who, in disregard of that wisdom, are constantly aiming to modify, by positive institutions, the natural order of society according to some arbitrary standard, instead of allowing it to advance in that course which is sure to conduct it, in the end, to the highest state of advancement of which it is susceptible. "Man," says he, in one of his early unpublished manuscripts, "is generally considered by statesmen and projectors, as the materials of a sort of political mechanics. Projectors disturb nature in the course of her operations in human affairs, and it requires no more than to let her alone, and give her fair play in the pursuit of her ends, that she may establish her own designs." "Little else," he adds, in another passage of the same paper, "is requisite to carry a state to the highest degree of opulence from the lowest barbarism, but peace, easy taxes, and a tolerable administration of justice; all the rest being brought about by the natural course of things. All governments which thwart this natural course, which force things into another channel, or which endeavour to arrest the progress of society, at a particular point, are unnatural, and to support themselves are obliged to be oppressive and tyrannical."

It is in this spirit that political economy must be studied, if it is to maintain that rank among the moral sciences which it deserves, and in which it was placed by its founder. It would, undoubtedly, be unfair to deny that any-

thing has been added to this science since the publication of the "Wealth of Nations." But if it were admitted that some errors of Smith have been pointed out by subsequent inquirers, it will hardly be allowed that one or two corrections of doctrine in particular points make anything like amends for what political economy has lost of late in public estimation by the different spirit which has dictated, and the different tone which has breathed through some publications of a more recent date. The subjects of which this science treats have occupied a very increased degree of the attention, in the last few years, of speculative men, of all parties. They have done more than this. The science has attracted the attention of public men and statesmen. It has been referred to in parliamentary discussions; and what would have been most gratifying to its great expounder, some of its leading principles have been recognised and acted upon in important, and we trust, in permanent legislative enactments. There has been mixed up with these debates, it is true, much that might have been well spared, without loss to the credit of the assemblies in which they have taken place, and much interested and ignorant opposition has been arrayed against every amendment of the law; but nothing has been said or done by the most ignorant and most interested opponent of the progress of sound, political, and commercial freedom, which would so much have grieved the author of the "Wealth of Nations," as the arrogant and intolerant spirit, the daring paradox, and dogmatical propositions which have been promulgated by some of his pretended followers.

It is not needful to say more upon this point; but we think it requisite to say so much, for the benefit of those who know nothing of the "Wealth of Nations," and nothing of political economy; and in order that they may not be turned away by any spurious disciples of the science, from the study of a work, of which it has been truly said,—"that, abstracting entirely the author's peculiar and original speculations, there is no book, perhaps, in any language, containing so methodical, so comprehensive, and so judicious a digest of all the most profound and enlightened philosophy of the age."

The title which Smith adopted for his work, admirable as it is, and expressive of the nature of his investigations; and the introduction, in which he presents a luminous outline of his method, give no indication of the many masterly collateral disquisitions contained in it; because, in so comprehensive a subject, it was not easy to express, nor is it always obvious for the reader to perceive, the reference they bear to the investigations with which they are associated. These disquisitions, however, form very often the most interesting and valuable portion of the book, to those especially who, having less relish for the study of some branches of political economy, are pleased when they find its reasonings made applicable to purposes of more general philosophy. We would instance the whole of the first chapter of the fifth book, as being of this description; and more especially Art. II. and III. of Part the 3rd, entitled, "Of the Expense of the Institutions for the Education of Youth, and of the Expense of the Institutions for the Instruction of People of all Ages."

It may be remembered too that in every science, the most important and interesting truths are very often such as are obvious to every capacity, and when clearly stated admit of no dispute; whilst those parts of it which are least valuable, and most liable to angry controversy, are happily such as comprise doctrines purely speculative, and which, if they are of difficult comprehension, may be safely left uncomprehended. Now, if this is true of any science, it is true of political economy: there are thorny and vexatious questions included within its range, but we doubt if, in any of the moral sciences, there are so many well ascertained truths of great and practical importance which may fairly be said to lie, with candid reasoners, beyond the reach of controversy.

### SECTION 6.—*From the publication of the "Wealth of Nations" until the death of Dr. Smith.*

THE two following years after the publication of the "Wealth of Nations" were spent chiefly in London; and Dr. Smith, as well he might, after ten years almost unremitting and severe application, relaxed his powers in the pleasures of society, and mingled with the many eminent men who were then at the head of wit and literature in the capital. Dr. Johnson, Burke, Gibbon, Beauclerk, Reynolds, and the other members of the

Literary Club, which had been formed many years before, and of which Smith had been previously a member, were among those with whom he associated at this time; but neither history nor tradition has handed down to us any of those sallies of colloquial wit and eloquence for which many of his contemporaries, far less distinguished than himself in the higher walks of philosophy and learning, have become celebrated with posterity. That he was not distinguished by the flow or force of his mind in conversation is quite evident; and he is reported to have said of himself, that he was so much in the habit of husbanding his resources for his works in the closet, that he made it a rule never to talk in society upon any subject which he understood. This story, however, we should be inclined to disbelieve. Such voluntary and deliberate abstinence from the pleasures of social converse, even if it were allowed to be a virtue, would evidently be one very difficult in practice: and instead of allowing him the credit of so rare a species of self-denial, we are more disposed, in accounting for his habitual reserve, to class Dr. Smith with some other very eminent men (Addison and Dryden are amongst them), whom Johnson has so admirably described in the following passage:—

"There are men whose powers operate only at leisure and in retirement, and whose intellectual vigour deserts them in conversation; whom merriment confuses, and objection disconcerts; whose bashfulness restrains their exertion, and suffers them not to speak till the time of speaking is past; or whose attention to their own character makes them unwilling to utter at hazard what has not been considered, and cannot be recalled."*

The light in which the characteristic quality of his mind was regarded by his friends may be partly gathered, amongst other testimonies, from the allusion to him in the verses which Dr. Barnard addressed to the members of the club, not long after the publication of the "Wealth of Nations." The stanza is as follows:—

If I have thoughts, and can't express 'em,
Gibbon shall teach me how to dress 'em
In words select and terse:
Jones teach me modesty and Greek,
*Smith how to think*, Burke how to speak,
And Beauclerc to converse.

In the year 1778, owing to the friendship of the Duke of Buccleugh, and in some measure, we may trust, as a reward for his invaluable labours, Dr. Smith was appointed one of the Commissioners of the Customs in Scotland; an office which occasioned him to fix his residence in Edinburgh, where he continued to the end of his life.

If we should consider this appointment only in the light of an acknowledgement, of a recompense too rarely bestowed by men in power, for labours purely philosophical, and having nothing to recommend them but their intrinsic truth and beauty, few things can be more gratifying than the contemplation, to every lover of science and of virtue. Even the rewards which have been occasionally bestowed upon men of genius, by princes and their ministers, have too often been conferred for its prostitution to the mere purposes of power; the price of its past or future service, or the bribe for its silence when that alone was to be bought.

In the instance before us, it is gratifying to know, that the reward, if it was so meant, was equally honourable to the giver and the receiver. The works which Smith had published for the instruction of the world, had nothing to do with the possessors of power in his day, but to enlighten and direct its exercise. The parties and factions belonging to the period when he wrote could derive no particular or personal advantage from his writings; but mankind, in every age, will find in them the best corrective to faction and to party, by contemplating those eternal political truths with which party has rarely had anything to do, but which are equally salutary at all times, and under every form of government, for rulers and their people.

But if we should consider that the appointment which was bestowed upon Smith, however gratifying in other respects, was the cause, as there is reason to fear, of an interruption to his studies, and of the loss to the world of those speculations to which he had alluded in the closing passage of his Moral Sentiments, and the completion of which he is known never to have entirely abandoned but with his life; we shall be disposed to lament, perhaps ungratefully to lament, that he who had already done so much for the advancement of moral and political science, was not permitted to do more, by the fulfilment of his engagement to give to

* Life of Dryden.

his country a theory of jurisprudence, and in this manner to finish the structure which he had designed in his earlier days, and to fill up the measure of his fame. There is the greater reason to lament this, because the office imposed upon this enlightened man was one of no dignity or importance; but a duty of mere routine, the discharge of which must have been irksome to a mind like his, accustomed during his life to so different an application of his faculties. He might have been called, like Turgot, to the administration of his country, have enjoyed the melancholy satisfaction of endeavouring to enforce the maxims he had taught, and have found, perhaps, like him in the end, that the intrigues of the cabinet, the favour of the court, and the prejudices of the people, are equally adverse to the temper and the triumph of philosophy.

It was about this period that his friend and early patron, Lord Kames, in preparing a new edition of his work on the "Principles of Morality and Natural Religion," was induced to call in question the theory of Dr. Smith, and he therefore sent him a copy of the strictures he intended to introduce upon his work, before he proceeded to publication. To this Smith replied in the following letter, which we hesitate not to subjoin,—first, because, as we have before remarked, there are so few of his letters extant, and secondly, as it serves to shew the courtesy with which philosophic controversy was carried on in those days, and would generally be carried on, if the love of truth, and truth only, inspired it.

"*November* 16*th*, 1778.

"My Dear Lord,

"I am much obliged to you for the kind communication of the objections you propose to make in your new edition, to my system. Nothing can be more perfectly friendly and polite than the terms in which you express yourself with regard to me; and I should be extremely peevish and ill-tempered if I could make the slightest opposition to their publication. I am, no doubt, extremely sorry to find myself of a different opinion both from so able a judge of the subject, and of so old and good a friend;—but differences of this kind are unavoidable, and besides—*Partium contentionibus respublica crescit.* I should have been waiting on your Lordship before this time, but the remains of a cold have, for these four or five days past, made it inconvenient for me to go out in the evening. Remember me to Mrs. Drummond, and believe me to be, my dear Lord, your most obliged,

"And most humble servant,

"Adam Smith."*

The greatest good conferred upon Dr. Smith by his official appointment, the greatest, indeed, that could be conferred by any additional wealth, was the power of extending the range of his benevolence, which is known to have been at all times exerted in acts of charity, far beyond what might have been expected of him, even after this moderate increase of his income. His excellent biographer has alluded to some remarkable instances of this nature in the life of Smith, which have been communicated to him by one of his confidential friends, where the assistance was on a scale as liberal as the manner of rendering it was delicate and affecting. Next to this was the satisfaction he derived from the privilege of spending the latter period of his life in the society of his oldest and dearest friends—free from those anxious cares with which the want of mere worldly competence has sometimes darkened the declining years of genius and of virtue. In the society of his mother, and of his cousin, Miss Douglas, who now formed part of his household, he enjoyed for some years every comfort and consolation that can be felt by one who is a stranger to the more endearing ties which bind a husband and a father. A simple, but hospitable table was always open to his friends.

In 1784 he lost his mother, and four years after, his cousin; and their death was felt by him as a severe and irreparable loss; little to be soothed by any worldly honour or applause; it being the effect, perhaps, of age and of all true wisdom, to render the mind as insensible to such vanities, as it is to dispose it to the influence of the social and domestic affections. Were it otherwise, the affliction under which he suffered might have been somewhat alleviated by one of the most gratifying circumstances

* There is a letter of Dr. Reid's extant, addressed to Lord Kames, in which he says that "after all, the system of sympathy is only a refinement of the selfish system," a criticism very like to saying that white is only a refinement on the colour of black—things, in which the plain sense of the world has discovered, some how or other, a pretty clear and durable distinction; notwithstanding the painter may blend them with his brush, or a logician, like Dr. Reid, confound them by his cavils.

of his life, which occurred about this period. In the year 1787 the University of Glasgow elected him rector of that learned body; and that he felt this compliment very sensibly, is manifest from the letter which he addressed to the principal of the college in acknowledgment of this flattering distinction—an honour, however, be it remarked, which could scarcely have been rendered where it would have reflected back so much credit upon those who had bestowed it, and which, we may venture to say, would not have been lessened in the estimation of Dr. Smith, had he lived to see it conferred upon some illustrious names who have shared it in our own times.

"No preferment," says he, "could have given me so much real satisfaction. No man can owe greater obligations to a society than I do to the University of Glasgow. They educated me; they sent me to Oxford. Soon after my return to Scotland, they elected me one of their own members, and afterwards preferred me to another office, to which the abilities and virtues of the never to be forgotten Dr. Hutcheson had given a superior degree of illustration. The period of thirteen years which I spent as a member of that society, I remember as by far the most useful, and therefore as by far the happiest and most honourable period of my life: and now, after three-and-twenty years absence, to be remembered in so very agreeable a manner by my old friends and protectors, gives me a heartfelt joy which I cannot easily express to you."

The life of this illustrious man was now fast drawing to a close. For a considerable period previous to his death his health had gradually declined, and his mind reverted in his last moments with renewed regret to what he had left undone of the works he had so long designed. His death was approaching far too rapidly to leave the slightest hope of doing more; and his anxiety about the fate of his manuscripts became excessive. It was so great, that during his last illness, after reiterating the most earnest entreaties for their destruction after his death, he was yet not satisfied, and desired that the whole of his papers, except the few fragments which he bequeathed to the care of Dr. Hutton, might be destroyed immediately. His mind seemed greatly relieved, when he was assured that this was done. A very few days before he died, he had two or three of his select friends to sup with him, as was his custom; but finding his strength fail him, he retired to bed, and as he went away, he took leave of them by saying, "I believe, Gentlemen, we must adjourn this meeting to some other place." In the previous winter he had prepared a new edition of his "Moral Sentiments," and in the advertisement which he prefixed to it, he had still allowed himself to express a last and faint hope that it might yet be permitted to him to complete his long-projected work on jurisprudence. Even then, the ardour of his mind would not suffer him altogether to relinquish a hope which, it was but too evident, could never be fulfilled. He died only a few days after the meeting to which we have referred, on the 17th July, 1790, bequeathing the valuable library which he had collected to his nephew, Mr. D. Douglas; appointing his friends, Dr. Hutton and Dr. Black, the executors of his will; and entrusting to them the charge of publishing the few unfinished sketches which had been allowed to survive him.

### Section 7.—*On the general Character and Writings of Smith.*

The character of Dr. Smith, like that of all men whose lives have been devoted to the pursuits of philosophy and science, may be best traced in his writings. It has perhaps been the fortune of few men so eminent to have engaged so little in the commerce and bustle of active life, and of few, it has been said, to have been so little fitted for it: yet the intellectual and moral capacities of this illustrious man were evidently of an order to have filled, and adorned, the highest station in society; and, notwithstanding the abstraction in which he lived, for the most part, from the business of the world, and some peculiar and characteristic traits which occasionally marked his habits and his opinions, it is clear that, with an understanding of the loftiest range, he was free, in many respects, from that exclusiveness and pedantry which have been sometimes ascribed to philosophers of great name, and which have given currency, we suppose, "to the opinion, so industriously propagated (says Mr. Hume) by the dunces in every age, that a man of genius is unfit for business." In the establishment of his most enlightened theories, and those least of all subject to be dis-

puted in their ultimate and general tendency, he did not lose sight of that modification which they may occasionally require in practice, for the accomplishment of an immediate and beneficial purpose; and if the evidence of many striking passages in his works may be trusted, he did not incur as a philosopher, and would not have incurred as a statesman, the censure of rashly and unfeelingly adhering to an abstract principle in disdain of the interests which might be prejudiced, or even the prejudices which might have been shocked, by its application.

Nothing is more obvious, and nothing contributes so much to the beauty and value of his writing, as that in all his speculations he carried human life along with him; he never forgot that it was the chief praise and glory of philosophy to teach men how to act and to live; and he breathes through every page the admirable sentiment of a noble author —" That whatever study tends neither directly nor indirectly to make us better men and better citizens, is at best but a specious and ingenious sort of idleness, and the knowledge we acquire by it only a creditable kind of ignorance—nothing more *." This is eminently displayed in that valuable chapter to which we have referred, in the fifth book of the " Wealth of Nations," on the " Institutions for the Education of Youth"— one of the most profound and powerful disquisitions in any language. Neither the abstractions of philosophy, nor the pride of learning, nor the habits of the professor, could render him insensible to the purpose to which they ought all to be subservient, namely, the real interest of those who are to be taught. But the spirit of monopoly in such institutions he shews to be as inimical to those interests as it is in every other case. " The endowment of schools and colleges," he says, " have been opposed to this interest; they have not only corrupted the diligence of public teachers, but they have rendered it almost impossible to have any good private ones. Were there no endowed institutions for education, no system, no science could be taught for which there was not some demand. A private teacher could never find his account in teaching either an exploded and antiquated system of science acknowledged to be useful, or a science universally believed to be a mere useless and pedantic heap of sophistry and nonsense. Such systems, such sciences, can subsist no where but in those incorporated societies for education whose prosperity and revenue are, in great measure, independent of their reputation, and altogether independent of their industry. Were there no such institutions, a gentleman, after going through, with application and abilities, the most complete course of education which the circumstances of the times were supposed to afford, could not come into the world completely ignorant of everything which is the common subject of conversation among gentlemen and men of the world." —" The discipline of colleges and universities," says he, in another passage, " is in general contrived, not for the benefit of the students, but for the interest, or, more properly speaking, for the ease, of the masters. Its object is, in all cases, to maintain the authority of the master; and whether he neglects or performs his duty, to oblige the students, in all cases, to behave to him as if he performed it with the greatest diligence and ability. It seems to presume perfect wisdom and virtue in the one order, and the greatest weakness and folly in the other. Where the masters, however, really perform their duty, there are no examples, I believe, that the greater part of the students ever neglect theirs. Such is the generosity of the greater part of young men, that so far from being disposed to neglect or despise the instructions of their master, provided he shews some serious intention of being of use to them, they are generally inclined to pardon a great deal of incorrectness in the performance of his duty, and sometimes even to conceal from the public a good deal of gross negligence."

Such are the manly and liberal doctrines which he has put forth on this all-important topic. How unlike to the contracted and monkish sentiments entertained by many men, a great portion of whose lives has been passed within the walls of an university; and that too in the capacity of public teachers!

He was an ardent lover of freedom, but his devotions were not paid to her as to an unknown goddess, of whose attributes he was ignorant, and to whom his offerings were but an idle and a gaudy worship. If he loved freedom, he understood, better than the lovers of freedom have always done, in what it consisted: by what institutions it might be rendered

* Lord Bolingbroke—On the Study of History.

most permanent, and its substantial blessings be more widely and equally diffused. The scorn of oppression and injustice was in him an active and discerning sentiment; and, in his ardour for the interests and happiness of mankind, he felt alike, whether the means by which they were inflicted were legal or illegal. The poor and the weak, the humble and the unprotected, he knew had, in every age, endured more of evil from the operation of unjust laws than they have ever done from the mere violation of law. It was their condition, that is, the condition of the great mass of society, which he studied and wrote to ameliorate; and his language never assumes a loftier or more ardent tone than when he advocates their interests,—the interests of mankind at large, against some crying wrong, sanctioned, as it may happen to be, by law or charter. We might refer in proof of this to his observations on the laws against the combination of workmen, where he vindicates the poor against the power of the rich—on the law of settlement, the law of entails, and the severe and contemptuous tone in which he censures the spirit of commercial monopoly under every form. Nor did he fail to visit with equal severity the sentiments in which such impolitic and unjust regulations have their origin. Witness the indignant manner in which he replies to the miserable complaints of those who, disposed to view every improvement in the condition of the labouring classes of society as an encroachment upon their superiors, censure every increasing comfort they enjoy as a luxury to which they have no right. As he reprobates the injustice and impolicy of any attempt to retard their advancement, if such were possible; so has he treated with still greater contempt the monstrous and cruel paradox which has been sometimes maintained, that a liberal rate of wages relaxes the industry of the labourer, and that he never works so well as when he is ill requited for his labour.

"The liberal reward of labour," says Smith, "as it is the effect of increasing wealth, so it is the cause of increasing population. To complain of it is to lament over the necessary effect and cause of the greatest public prosperity. As it encourages the propagation, so it increases the industry, of the common people. The wages of labour are the encouragement of industry, which, like every other human quality, improves in proportion to the encouragement it receives. Where wages are high, accordingly, we shall always find the workmen more active, diligent, and expeditious. In cheap years, it is pretended they are generally more idle, and in dear ones more industrious than ordinary. A plentiful subsistence, therefore, it has been concluded, relaxes, and a scanty one quickens their industry. That a little more plenty than ordinary may render some men idle cannot be doubted; but that it should have this effect upon the greater part, or that men in general should work better when they are ill fed than when they are well fed, when they are disheartened than when they are in good spirits, when they are frequently sick than when they generally are in good health, seems not very probable." . . .

"Our merchants and master-manufacturers too (he says, in another part of his work) complain much of the bad effects of high wages in raising the price, and thereby lessening the sale of their goods both at home and abroad. They say nothing concerning the bad effects of high profits. They are silent with regard to the pernicious effects of their own gains. They complain only of those of other people."—*Wealth of Nations*, Book I. ch. 8—9.

Yet his zeal in the best of causes never made him lose sight of the end of all law—the preservation of the peace of society. He takes care to shew that it is not the province of a good or a wise man to seek the establishment of his principles by violence or undue pertinacity, and in disdain of the prejudices and institutions of the community which he seeks to influence.

"The man, whose public spirit is prompted altogether by humanity and benevolence (he says, in one of the finest passages of his writings) will respect the established powers and privileges even of individuals, and still more those of the great orders and societies into which the state is divided. Though he should consider some of them as in some measure abusive, he will content himself with moderating what he often cannot annihilate without great violence. When he cannot conquer the rooted prejudices of the people by reason and persuasion, he will not attempt to subdue them by force; but will religiously observe what by Cicero is justly called the divine maxim of Plato, never to use violence to his country, no more

than to his parents. He will accommodate, as well as he can, his public arrangements to the confirmed habits and prejudices of the people, and will remedy, as well as he can, the inconveniences which may flow from the want of those regulations which the people are averse to submit to. When he cannot establish the right, he will not disdain to ameliorate the wrong; but, like Solon, when he cannot establish the best system of laws, he will endeavour to establish the best that the people can bear*."

Finely as he has tempered in his writings the rigour, if we may so speak, of his speculative doctrines; and careful as he is at all times, by the infusion of moral sympathy, to correct any error or evil that might lurk in the logical inferences to be deduced from them; with a sagacity in his general reasonings, alive to the nicest shades in the conduct of the understanding and the passions; his excellent biographer has given us reason to think that his unpremeditated opinions both of men and books were not always such as might have been looked for, from the soundness of his judgment, and the singular consistency of his principles as a philosopher. His discernment of the character of individuals was often defective, and apt, like his particular judgments on other occasions, to be influenced by accident and humour. He seemed to be habitually inattentive to familiar objects and common occurrences, and "has frequently exhibited instances of absence," says Mr. Stewart, "which have scarcely been surpassed by the fancy of La Bruyère."

Some striking and amusing instances of this infirmity have been recently made public, by a lively and agreeable writer, from whose powers of humorous description, however, it may well be supposed they have lost nothing in the narrative.† We will mention one circumstance which is recorded by Mr. Mackenzie, in illustration. When that gentleman wrote the beautiful story of La Roche, in the 'Mirror,' in which, with reference to the character of Mr. Hume, he embodied the sentiments which the good nature and benevolence of that illustrious man might have suggested under the circumstances imagined, he was particularly anxious that there should not be a single expression in it, which could give offence or uneasiness to any friend of Mr. Hume's; and he read the story to Dr. Smith, desiring him to say, if there was anything in it that he would wish to be omitted or altered. He listened to it very attentively from beginning to end, and declared that he did not find a syllable to object to, but added (with his characteristic absence of mind, says Mr. Mackenzie), *that he was surprised he had never heard the anecdote before.*

It may be easily supposed that with such a propensity to abstraction, he did not readily fall in with the tone of general conversation, and that in consequence of that, and of his professional habits as a lecturer, he was apt to express rather exclusively, the result of his own meditations, without sufficient reference at all times to the topic in hand, or the immediate purpose of its discussion; and that his style had more of the precision of a formal discourse, than of the ease and freedom which constitute the charm of colloquial intercourse. It is reported of him too that he was occasionally more positive in the assertion of his opinions than is always becoming in a philosopher, and that notwithstanding the extent and variety of his information, he erred sometimes from taking a partial and peculiar view of a subject, as it might chance to be connected at that particular moment with some passing speculation in his mind.

His learning was extensive and profound. His study had not been confined to the subjects which might appear to have occupied the whole labour of his life. The sciences of ethics and politics were not taken up by him, as detached and abstract branches of philosophy. They came presented to his mind as part of the greater science of human nature, to which he had always devoted himself; and in the contemplation of which he borrowed every aid which a careful observation of the various institutions which have existed among men, their history, their language, and the monuments of their arts and letters, could afford him. But he loved literature, as he loved virtue, for its own sake, for its intrinsic beauty and worth. In its best records, those which exhibit the actions, and display the passions and sentiments of men, whether in philosophy where they are traced to their causes; in history, in

* Moral Sent. vol. ii. part vi. sect. 2.

† Vide Quart. Rev. On the Life of John Home, ascribed to Sir Walter Scott.

poetry, and oratory, where, under different forms, they are beheld in their operation; amid that exhaustless variety of circumstances and vicissitude of fortune, under which man has been seen at once an agent and a victim; he found the everlasting materials for his speculations, the real and only data of all moral science. He did not affect to despise, economist as he was, the imperishable productions of human wit and genius, the poetry of Homer or of Milton, the eloquence of Demosthenes, or of Fox; because he could find in their works no argument for the theory of rent, or the doctrine of population. Nor was he pleased to think it the part of a philosopher or a philanthropist, to sneer at the domestic affections, and the social virtues, in the most comprehensive investigations which he instituted, and which had for their object the common benefit of mankind.

In his last hours he found delight in the tragedies of Euripides and Racine; and the drama, and the principles of the dramatic art, and of poetry in general, formed a frequent and favourite topic of his conversation. He was a great advocate for rhyme, a more unqualified one even than Dr. Johnson, for he was accustomed to contend for the propriety of it as well on the stage, as in all other departments of poetry*.

As he loved to read it, he was accustomed to quote poetry, and the number of beautiful passages which he had treasured in his memory, and was in the habit of introducing in conversation, was remarkable in a man distinguished by so many higher acquisitions.

His peculiar taste is best exemplified in the style of his writings, which possess, even in that respect alone, merit of a very high order. If he has not (and who has?) the grace, the "careless, inimitable beauties,"† of Mr. Hume, it was owing in some measure to his not having mixed in such varied society; a circumstance which, acting upon the refined taste of the latter, lent to his compositions that inexpressible charm, which Gibbon may be supposed to have felt, when he describes himself in his ambition to emulate him, as "closing the volume with a mixed sensation of delight and despair*."

The great aim of Dr. Smith as a writer, and his great merit, is a marvellous perspicuity in the exposition of his ideas. Often diffuse, but never prolix; sometimes condensed, but never entangled in his expression; he unfolds the process of his reasonings so amply, that he leaves nothing to be supplied by his reader but a careful attention to his matter. Mr. Fox however is reported to have said of him, perhaps hastily, that he was unnecessarily diffuse, and fond of deductions where there was nothing to deduce. Mr. Stewart, with greater reserve, has ventured to hint a criticism nearly similar, and has ascribed this quality in his compositions to his early fondness for the study of the Greek geometry.

His greatest defect in the "Wealth of Nations," along with some faults in the arrangement of his subject, arises from his frequent digressions; his long dissertations upon some incidental questions, which frequently encumber the text, and intercept that complete and unbroken view of the subject as a whole, which a didactic author, who desires to interest and inform his reader, should always endeavour to preserve, from the first simple proposition with which he sets out, to the final developement of his system in all its parts. This defect arose partly from a peculiarity in his judgment, which led him to reject the use of marginal annotations; so useful in treating of many subjects, and certainly, it would seem, not the least so, in many which Dr. Smith undertook to discuss in his great work. It is curious, however, that, in the "Wealth of Nations," there are, we believe, but three or four notes, of four or five lines each, in the whole work, and these containing little more than references to authorities; whilst, in the "Theory of Moral Sentiments," there occurs but one of considerable length, and of importance more than equal to its length, in which it is remarkable that he has embodied a piece of reasoning, having essential reference to his system, of which it may be said, indeed, to furnish one of the strongest supports,

* It is well known that the two Doctors got to rather high words once at Mr. Dilly's table, where they met at dinner. Many years after this, when Johnson, on some occasion, was maintaining the superiority of rhyme over blank verse, Boswell observed that he had heard Adam Smith enforce the same criticism in his lectures at Glasgow. "Sir," said Johnson, "Smith and I once met, and we did not much take to each other; but if I had known *that the dog loved rhyme as much as you say he does, Sir, I should have hugged him.*"

† Gibbon's Memoirs.

* Gibbon's Memoirs.

and the clearest illustrations to be found, perhaps, in the whole work.*—†

There is no doubt that he bestowed great care upon the style and composition of his works. And after all his practice as a writer, he is said never to have acquired that facility which is often attained by it, but to have written as slowly, and with as much labour at last, as he had ever done. This however was the effect, in some measure, of the nature of his speculations, and the general character and conduct of his understanding. In all his works, though we find passages of exceeding eloquence, force, and beauty, he is most distinguished for being a deliberate reasoner, and a candid and cautious thinker. It was usual with him, when employed in composition, not to write with his own hand, but to walk about his room dictating to an amanuensis. He had collected, in the course of his life, a very valuable library, which he bequeathed to his cousin, Mr. David Douglas. As he was a lover of books, he was more attentive to their condition, and the outward fashion of them, than is usual with scholars in general. When Mr. Smellie once called upon him, and was admiring a splendid copy of some classic author, and the general elegance of his shelves,—"You see, Sir," said Smith, "if in nothing else, I am a beau at least in my books."

Besides the two great works of which we have spoken, and on which the fame of Dr. Smith will for ever rest, we must not omit to mention the very original and ingenious dissertation on the formation of languages, which was appended to the early editions of the "Moral Sentiments," and still continues to be published along with that work; and the few masterly, but unfinished sketches which were published shortly after his death. The tract on languages is a piece of extensive learning and profound observation; but though Mr. Stewart has bestowed high praise upon it, it seems hardly to have attracted the notice it deserves. The longest and most important of the posthumous essays, is entitled a "History of Astronomy," in which the author proposes to illustrate the principles which suggest and direct philosophical inquirers, by an account of the origin and progress of that interesting science. The same train of thought was pursued in two shorter and more imperfect essays, on the "History of the Ancient Physics," and that of the "Ancient Logic and Metaphysics." Along with these is a disquisition of very great beauty, entitled, with his accustomed amplitude of language, "On the Nature of that Imitation which takes place, in what are called the Imitative Arts;" and another, on the "External Senses"—all abounding in great originality of thought, exquisite illustration, and expression the most expanded and luminous.

In the "Sketches of the History of Philosophy," we find the same turn and tendency of mind which he has displayed in his greater works; a disposition which delighted to ascribe the first exercise of the imagination and the intellect, not to any view of profit or advantage in its results, but to a natural desire to fill up the void which was felt by the mind, from its inability to comprehend and connect together the various, and, as it would seem, the disjointed appearances which present themselves to its contemplation in the scenes and operations of nature. "Philosophy," says Dr. Smith, "is nothing but the science of the connecting principle of nature." It is an art addressed to the imagination, which seeks to adapt and reconcile to that faculty some theory, more or less satisfactory, of the phenomena, which, at first view, are void of order and connexion, and of meaning. The superiority of the Newtonian philosophy, he maintains, consists only in this,—that it is the most pleasing solution of the great problem of nature which has yet been given—that it connects more easily and more simply the appearances of the heavens in the fancy—not that it is by any means to be regarded as unfolding the actual chains which nature makes use of to bind together her several operations.

In the few observations which have been made upon the writings of this illustrious man, as in the short extracts introduced from them, it has been less our object, as will be seen, to dwell upon

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* Dr. Smith was betrayed into this rejection of marginal writing, by his classic adherence to the plan of composition of the ancients, who were equally ignorant of the use and the abuse of our modern practice; but many of whose works would evidently have been much improved by a moderate adoption of it; and every reader of the "Wealth of Nations" must have felt how much he would have been relieved in the study of this great work, if many portions of it, which might be pointed out, had been removed from the text to the margin, to be consulted in their proper places, and not allowed to interrupt, as they often do, a chain of profound and subtle reasoning, or an interesting deduction of consequences of the highest importance to the establishment of the point in question.

† Vide "Theory of Moral Sent.," Part ii. Sect. 1.

their merits with reference to any *system*, either of morals or economy, or to the soundness or fallacy of any particular doctrine, than to point out the admirable spirit which animates every part of that system; and those principles to which he always appeals, as the legitimate sources whence alone we can draw the materials of all moral and political institutes. To have done more than this, to have given even a very brief abstract of his system, in either of his two great works, would have far exceeded the limits of the present memoir; would require, and might well deserve, a separate treatise.

What has been attempted, however imperfectly, may not be altogether without its use, at least until propositions in the moral, as in the mathematical sciences, shall admit of demonstration. When that shall be the case, and the results of our reasonings can be submitted to so decisive a test, the sources whence we derive them, and the mode in which they are conducted, may be alike indifferent, and cannot assuredly affect in the slightest degree the truths demonstrated. Till then, however, it must be considered as no unimportant part of that species of philosophy which, in the expressive language of Lord Bacon, comes home to men's business and bosoms, to temper its doctrines by moderation and modesty; to engage the sympathies on our side of those we undertake to teach, and not to repel them; to endeavour to shew, if we can, that the doctrines we inculcate may be traced to a higher wisdom than that of man, by being in conformity with the rules by which nature seems to work, and in furtherance of principles which she has evidently implanted for the accomplishment of her own great ends.

No philosopher has so constantly borne in mind as Dr. Smith, that in the moral, as in the physical constitution and frame of man, nature has made certain provisions for his attainment to virtue and to happiness, which the ignorant may overlook, and the arrogant may disregard, but with which the wise will only study to co-operate. And all the precepts we can put forth will derive their best sanction, and afford the strongest presumption in their favour by their being shewn to be in unison with those simple instincts of our nature, by which alone, as individuals, we are first taught to apprehend a distinction betwixt good and evil,* and which, in the obvious arrangements they suggest for the social union, were equally intended by our great Creator as lights to the economist and the legislator for the framing of those laws and institutions which take place in the wider and more complicated associations of men. It was in this excellent and truly enlightened spirit, that Smith, by applying the experimental method of reasoning to moral subjects, attained the vantage ground of that higher philosophy of which it is the glory of Bacon to have pointed out the road;—by which Newton ascended to the discovery of the sublimest truths in physics;—and by the careful cultivation of which alone, if ever, it may be hoped, that the moral and political sciences will be placed on a foundation equally enduring, and when knowledge in them will more surely become power to man, as their reference to his happiness and advancement is more obvious and immediate.

* It has become usual of late, even in moral and political discourses, to regard all reference to authority as marks of a poor and illogical understanding. In the physical sciences, those more especially which rest upon mathematics, (as we have said in the text) the argument from authority is of course out of the question. It is different we conceive in other subjects;—and though we have little respect for an hypothesis, however supported, which appeals *from* the universal sense and feelings of mankind, an authority that appeals *to* that sense and those feelings is entitled to a good deal, and for our parts we should be satisfied to take our chance of error, in a question concerning the principle of moral approbation—for instance, with Hume and Smith, and Stewart and Mackintosh.

HOPPUS, John

(12)

# AN ACCOUNT

OF

# LORD BACON'S

# NOVUM ORGANON SCIENTIARUM;

OR,

# NEW METHOD OF STUDYING THE SCIENCES.

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*THE FIRST, OR INTRODUCTORY PART.*

Sir Francis Bacon, Lord Verulam, is justly held the founder of *Experimental Philosophy.* He proposed his plan in his *Instauratio Magna,* with so much strength of argument, and so just a zeal, as renders that admirable work the delight of all who have a taste for solid learning.—MACLAURIN'S *Account of* NEWTON'S *Philosophical Discoveries.*

# ACCOUNT

OF THE

# NOVUM ORGANON.

HOMO, NATURÆ MINISTER ET INTERPRES, TANTUM FACIT ET INTELLIGIT QUANTUM DE NATURÆ ORDINE RE VEL MENTE OBSERVAVERIT; NEC AMPLIUS SCIT, AUT POTEST.——*Nov. Org.*

Lord Bacon was the first who taught the proper method of studying the sciences: that is, he pointed out the way in which we should begin and carry on our pursuit of knowledge, in order to arrive at *truth.* He gave a set of rules by which mankind might deliver themselves from slavery to names, and from wandering among fanciful systems, and return once more, as little children, to the school of nature. The task he chose was far more useful to the world, and honourable to himself, than that of being, like Plato or Aristotle, the author of a new sect: he undertook to expose the errors of those who had gone before him, and to shew the best way of avoiding them for the future: he had the principal share in pulling down the old building of a false philosophy, and, with the skill of a superior architect, he laid the foundation, and sketched the plan of another fabric; and gave masterly directions to those who should come after him—how, upon the ruins of the first, the temple of science must be erected anew. As, in a great army, there are some whose office it is to construct bridges, to cut paths along mountains, and to remove various impediments, so Lord Bacon may be said to have cleared the way to knowledge; to have marked out the road to truth; and to have left future travellers little else to do than follow his instructions: he was the miner and sapper of philosophy, the pioneer of nature; and he eminently promoted the dominion of man over the material world. He was the priest of nature's mysteries; and he taught men in what manner they might discover her profoundest secrets, and interpret those laws which nature has received from the great Author of all.

It is the object of this Treatise to make our readers acquainted with Lord Bacon's Philosophy, as it is contained in his great work, the *Novum Organum;* in which we find the principles of that improved

method of conducting the inquiries of science, which has now so long and so happily prevailed. To accomplish this design with the more effect, it will be desirable, first, to draw their attention, in a few words, to the state in which Bacon found the world, as to knowledge and science, at the time when he flourished. For, as the returning light appears more glorious after the sun has been eclipsed—and the order and beauty of nature would look doubly striking to an eye that had seen that chaos from which she first arose, when all was without form and void,—so, if we glance, but for a moment, at that darkness which so long overshadowed the human mind, and gave birth to so many phantoms and prodigies, under the name of science, this retrospect will serve to show more clearly the merits of a philosopher, who may be regarded as the morning star of that illustrious day which has since broken out upon mankind; and in the spirit of whose method, even the immortal NEWTON himself explored the heavens—by the aid of a sublime geometry, as with the rod of an enchanter, dashed in pieces all the *cycles*, *epicycles*, and *crystal orbs* of a visionary antiquity; and established the true Copernican doctrine of astronomy on the solid basis of a most rigid and infallible demonstration.

In several of the fine arts, in which chiefly the taste and imagination are concerned, such as poetry, rhetoric, statuary, and architecture, the ancients, according to general opinion, have equalled, if not surpassed, any of the moderns. Homer and Demosthenes continue, notwithstanding the flux of time, to retain their station as the masters of eloquence and song; and those exquisite statues, the Venus and the Apollo, still command our admiration as perfect models of what is chaste, and severe, and beautiful in the art of sculpture. The ancients nobly distinguished themselves also in those more rigorous exercises of the understanding which are demanded by pure mathematics; in proof of which it is sufficient to quote the name of Euclid, and of Archimedes whose discoveries in geometry and mixed science entitle him to be regarded as the *Newton* of all antiquity; but it was reserved for the moderns to invent a *calculus*—a new and more profound arithmetic, which was called for by a more exact acquaintance with nature herself, and was to be applied to that more improved state of natural science which is peculiar to later times: we allude to the doctrine of *fluxions*, or the *differential* method of Newton and Leibnitz; since cultivated, and applied to physical astronomy with great success by the French, and especially by LA PLACE. In most of those branches of knowledge, however, which rest on the basis of *experiment* and *observation*, the ancients almost entirely failed. The case is, that to form *theories*, or systems of science and philosophy, from a hasty view of facts and appearances, is an easy task, since this can be done without the labour of close and patient thinking: and if antiquity be, in truth, as Bacon himself represents it, but the childhood and youth of the world, it is nothing more than we might expect that, at that period of its existence, imagination should prevail over reason; and that the calmer and more successful exercises of the latter should not unfold themselves till a maturer age.

One instance, out of many, in natural science, may suffice to convince the reader to what absurd and extravagant notions the

mind can reconcile itself, when once permitted to rove into the regions of imagination, unrestrained by that strict and scientific method, so successfully pointed out by Lord Bacon, and which it is our present object to explain. *Cosmas Indopleustes*, who lived so late as the *sixth century*, affirmed that the earth was an oblong plane, surrounded by an impassable ocean; an immense mountain in the form of a cone, or sugar-loaf, placed in the north, was the centre around which the sun, moon, and stars daily revolved: the shape of this mountain, and the slanting motion of the sun, accounted for the variable length of the days, and the changes of the seasons. The heavens were supposed to be an immense arch, one side of which rested on the earth, and the other on two mighty pillars beyond the sea; under this vault a multitude of angelic beings were employed in guiding the motions of the stars. Such was the theory which gravely presented itself for adoption, seven or eight centuries later in the world than Euclid, Archimedes, and Apollonius!

Abundant instances of almost equal absurdity might be collected from the opinions of the ancients, on various other branches of science. Take, for example, the doctrine of *sensation*, or feeling, in what was called the *Peripatetic* school, so called from a word signifying to *walk about*, because it was customary for the disciples to study and dispute as they walked in the *Lycæum*, a place at Athens which was appropriated to their use. Of this school, the founder was Aristotle, a man of immense genius, who obtained the greatest popularity, and the most extensive influence over the opinions of mankind, of all the philosophers of antiquity, and who held the minds of men in a kind of intellectual bondage for about two thousand years. In the Peripatetic philosophy, what takes place in *sensation* was thus described: a sort of images, or, as they were termed, *sensible species*, that is, certain films of the shape of bodies, came off, it was said, from the objects of sense, and arriving at the organs which were proper to them, were admitted to the nerves, and by them conveyed to the brain: here these images were impressed, as the engraving of a seal on wax, and being now refined into what were called *intellectual species*, the whole business of sensation and perception was supposed to be accounted for. Thus by a jargon of words were men taught to believe they understood the manner in which *matter* communicates with *mind* or *spirit*, and their operation upon each other, which, all that has ever been said or written on the subject, shows to be inexplicable, and to be received simply as a *fact* in the constitution of sentient being.

Up to the time of Lord Bacon, Aristotle still maintained, in a very great degree, his dominion in the realms of philosophy—a dominion which, at some periods, had been scarcely less absolute over the minds of men, and far wider and more lasting than ever his renowned pupil Alexander was able to secure over their bodies. Possessed of a most acute and penetrating mind, and a singular talent for minute investigations, he was qualified, in this respect, for philosophical inquiries far more than ordinary men. His writings in natural history in particular, constitute a mass of physical and anatomical facts, which must have resulted from a course of very diligent observations. Neglecting, however, that rigid and exact practical method which is essential

to all natural science, too much devoted to subtil distinctions of words; and too ambitious of gaining an ascendancy over the opinions of mankind, he pronounced too boldly on nature's operations, and spent his energies too often in useless or obscure questions. In his desire to set up his own dogmas, in opposition to ancient opinions, he is sometimes guilty of misrepresenting the philosophers of a remoter antiquity; and he frequently veils himself in an obscure and unintelligible jargon. Lord Bacon describes his propensity to tyrannize over men's minds, by saying that, "as though he had been of the race of the Ottomans, he thought he could not reign securely unless all his brethren were slain." Cicero, who seems to have had some respect for Aristotle's philosophy, acknowledges that, in his time, it was understood by very few even of the philosophers themselves. His *Logic*, which is peculiarly his own, is undoubtedly a great effort of human ingenuity; it consists in an *analysis* of that process of the mind which, however rapid, and almost imperceptible, must take place in all sound and correct reasoning. It furnishes the model to which all such reasoning may be reduced, and serves as a test by which the justice of an argument may be tried, if it be ever necessary thus minutely to put down all the steps by which the conclusion is arrived at. In the discoveries of science it can of course afford little or no assistance, and it was the mistaken attempt to employ it for this purpose, that so long excluded the proper method of entering on philosophical researches, and filled the minds of men with mere words, and confused notions. Bacon's observations on this subject in his *Advancement of Learning*, show that his frequent condemnations of the logical philosophers were levelled against the extravagant perversions of Aristotle's *Dialectics*, with which these schoolmen were chargeable, and to which Aristotle himself had led the way. His logic was the engine by which, for ages, the minds of men were bewitched in a manner that was altogether extraordinary, and diverted from things themselves to mere words.

The philosophy of Aristotle, which it would be foreign to the purpose of this treatise more than to characterize generally, without entering into its details, obtained the same credit at Rome, under the Cæsars, which it had already acquired in Greece; being patronized by both Julius and Augustus. Towards the close of the fifth century, the influence of Aristotle began to prevail over that of Plato in the Christian world. After considerably declining during the sixth century, it again revived; and in another century it had gained such an ascendancy that Aristotle seems to have been every where triumphant. Glosses, paraphrases, summaries, arguments, and dissertations on his works were composed without end; as if to make "darkness visible." Many of the inhabitants of the west learned Arabic in order to read a translation of them in that language. The Latin tongue was made another medium of their circulation, and they were read in most parts of the known world. Men were every where taught to believe in *matter*, *form*, and *privation*, as the origin of all things; that the heavens were self-existent, incorruptible, and unchangeable; and that all the stars were whirled round the earth in solid orbs! Aristotle's works were the great text-book of knowledge, and his logic was the only weapon of

truth. Men's minds, instead of simply studying nature, were in an endless ferment about occult qualities and imaginary essences; little was talked of but *intention* and *remission*, *proportion* and *degree*, *infinity*, *formality*, *quiddity*, *individuality*, and innumerable other abstract notions. The Latin tongue, which was employed by these scholastics, was converted into a barbarous jargon, which a Roman would not have understood; and, in the end, the most sectarian bitterness was produced, sometimes ending in bloody contests. In the midst of these disputes, Aristotle was still the grand authority. Christians, Jews, and Mahometans, united in professing assent to the great lawgiver of human opinions: not Europe alone, but also Africa and Asia acknowledged his dominion; and while his Greek originals were studied at Paris, translations were read in Persia and at Samarcand.

The rage for disputation which now began to prevail in consequence of the spread of this philosophy, induced the council of Lateran, under Pope Innocent III., to proclaim a prohibition of the use of the physics and metaphysics of Aristotle; but awful as were then the thunders of the Vatican, they were not mighty enough to dethrone him from that despotism over men's minds, which, by long custom, had now rendered itself almost omnipotent. The passion for the Aristotelian subtilties had become so general, that, notwithstanding Pope Innocent's decree, it was soon found necessary to favour publicly, in some degree, at least, the study of their author; and accordingly, his Dialectics, Physics, and Metaphysics were received into the University of Paris by an express statute to that effect. In England his doctrines were cherished with as great an eagerness as elsewhere. From about the end of the twelfth century the very name of Aristotle operated like a charm; his writings had obtained universal circulation, and in some of the universities of Europe statutes were framed which required the professors to promise, on oath, that in their public lectures on philosophy they would follow no other guide!

From this period till the close of the sixteenth century, though the authority of Aristotle still continued in the schools, the minds of men were gradually preparing to shake off his yoke, and a more propitious era was fast approaching. The revival of learning in the fifteenth century, the invention of the art of printing, and the Reformation, had done much to prepare the world for that new light which was afterwards to be cast over the fields of science, hitherto covered with darkness, and peopled only with airy and delusive phantoms. A few distinguished men—as *John of Salisbury*, *Gros-tête*, Bishop of Lincoln, *Roger Bacon*, *Ludovicus Vives*, and others, had taught mankind that neither the decrees of the Vatican, nor those of the Grecian schools, were incapable of being resisted. *Gilbert* had successfully investigated the laws of magnetic attraction, and furnished an excellent specimen of reasoning from experiment. In opposition to the system that was held by Aristotle and his followers, which made the earth the centre of the universe, *Copernicus* had revived the ancient Pythagorean doctrine of the earth's motion round the sun, and had discovered the true theory of the planets. *Galileo*, *Kepler*, *Gassendi*, and others who lived at the same time with Bacon, were acquiring a well-earned fame by their improvements in geometry and physics; and the whole world of science

already sighed to be redeemed from the darkness of the middle ages, and the bondage of the schools. *Martin Luther*, who had been taught the philosophy of Aristotle in his youth, had expressed his contempt for its vanities, and rejected it with indignation. *Ramus*, also, had attacked the existing opinions at Paris, and disputed publicly against Aristotle's doctrines in the university of that city. Like many other honest followers of truth, however, in this wretched world, which has always loved darkness rather than light, he suffered severely for his boldness. As a punishment for his presuming to question the infallibility of the great despot of all knowledge, in an edict of the French parliament, under Francis I., the said Peter Ramus is gravely pronounced to be " insolent, impudent, and a liar ;" his books are, now, and for all time coming, condemned, suppressed, and abolished, and the author is solemnly prohibited from copying, or even reading, his own works. *Bruno*, *Campanella*, *Patricius*, *Nizolius*, and some others, also contributed their part to undermine the influence of Aristotle.

It was reserved, however, for Francis Bacon, Lord Verulam, to break the spell of the mighty enchanter of Stagira, and to give a final blow to the scholastic philosophy ;—to make one grand and general attempt to deliver men's minds from the bondage of two thousand years ;—to assert the right of that reason with which the beneficent Creator has endowed man, as above all authority merely human ;—and to sketch the outline of one grand and comprehensive plan, that should include in it the endless varieties of our knowledge, and guide our inquiries in every branch. Born in the year 1561, and early entered as a student at Trinity College, Cambridge, this great genius soon began to feel dissatisfied with the vagueness and uncertainty of the existing state of knowledge, the want of connexion between the sciences and the arts, and the consequent uselessness of the reigning speculations as regarded the purposes of life. The more he thought on the subject, the more he was convinced of the vanity of the scholastic learning of the times, and of the necessity of a thorough reformation in the method of treating the knowledge of nature, by laying aside all conclusions not founded on observation and experiment. He saw plainly that a great part of the evil lay in the extensive influence which Aristotle still possessed in the schools; that *nature* and *fact* were neglected for the study of his doctrines, which were the arbiters in all disputes; the properties of matter, and the laws of motion, by which all effects are produced, were lost in useless distinctions and dry definitions; the powers of the mind were exhausted in grave trifling and solemn folly; and the real advancement of human knowledge was altogether hopeless, so long as such a state of things prevailed. A century or two earlier, the contests about *names*, and *forms*, and *essences*, were sometimes more serious than a mere strife of tongues: they ended in actual bloodshed; while the disputants took the side either of *Occam*, " *the most subtil*," or *Duns Scotus*, " *the invincible*," the famous champions of the day; and if the din of this philosophical, or rather *un*philosophical war now raged no longer,—if those imposing titles were not now heard which had formerly been bestowed on the leaders of rival parties, such as the *most profound*, the *marvellous*, the *perspicuous*, the *irrefragable*, the *most resolute*, the *angelical*, the *seraphic doctor*,—it was that all inquiry had well nigh

ceased, and the minds of men were cast, with a very few exceptions, into a profound slumber, and filled only with the romantic visions of an imaginary philosophy.—Such had been the state of things at the time of Lord Bacon, and the brief notice we have taken of it may serve to throw light on the real value of his labours, which had for their object the establishment of a philosophy that is in fact no other than the philosophy of reason and common sense, in opposition to all mere theory and fancy, and to all imposition.

Under these circumstances Bacon wrote his Organon. His qualifications for this bold attempt to clear the barren wastes of science, and to sow the seeds of a new creation of useful knowledge, will be best seen by studying his doctrines. We shall, therefore, now proceed to give an account of this most important and considerable part of his general work, the *Instauratio Magna*, or *Instauration of the Sciences.* Its title was probably suggested by Aristotle's *Organon*, containing his Logic; it is called *Novum Organon Scientiarum*, or *a new Method of Studying the Sciences*, from the Greek word *organon*, which signifies an *instrument* or *machine.* The grand principle which characterizes this great work, and by the proper use of which its author proposes the advancement of all kinds of knowledge, is the principle of *Induction*, which means, literally, *a bringing in;* for the plan it unfolds is that of investigating nature, and inquiring after truth, not by reasoning upon mere conjectures about nature's laws and properties, as philosophers had been too much accustomed to do before, but by *bringing together*, carefully, and patiently, a variety of particular facts and instances; viewing these in all possible lights; and drawing, from a comparison of the whole, some general principle or truth that applies to all. The foundation of this philosophy lies, in short, in the *history of nature itself*—in making a laborious collection of the facts relating to any one subject of inquiry, previously to any attempt at forming a system or theory. Actual experiment, which Bacon significantly terms "asking questions of nature," must be resorted to, where experiments, as in chemistry, can be made: observations must be accurately collected, in the subjects proper to these, as astronomy; and conclusions are, in all cases, to be drawn only from what is actually witnessed, after the comparison of a sufficient number of facts, and a due regard to objections. In his treatment of this important subject of Induction, a new and more rational employment of the faculties is exhibited than the world had ever seen; and never before was there laid down to the minds of men the true theory of investigating all truth, whether natural or moral: indeed, Bacon has well merited the appellations he has received—the *Prophet of the Arts*, and the *Father of Experimental Philosophy.*

To point out the amazing success which has attended this system, which may be called the *Baconian* method, in the hands of the moderns, were an endless task—it would be to give nothing less than the history of science for the last two hundred years. The constellation of geniuses that rose in the next age mostly looked up to Bacon as their leading star. Newton himself was able to outshine them all, not merely by the energy of his own mind, but by his imbibing most deeply the spirit of this philosophy. No feature of Newton's intellect was more remarkable than the singular command he possessed over his

imagination, by which he was enabled to construct theories, more surprising than all the visions of fancy, yet on a foundation that must remain unshaken so long as the human mind and truth continue what they are. We may name his *Optics*, in passing, as a triumphant example of the *Inductive* method, in which, by experiment and observation as the basis of his calculations, he has treated of the nature and properties of *light*, one of the most subtil of all things, in a manner that cannot fail to surprise and delight the reader: with so much accuracy and precision is this wonderful element reduced to certain laws, as truly as the most gross and solid bodies. Having found, by very accurate experiments, that light always proceeds in straight lines, and that the rays of it are reflected and refracted according to certain fixed and unchanging laws,—on this experience he establishes the whole theory of *optics*, or the science of *vision;* and thus this science is founded on the *induction* we speak of.

Again—the mere falling of a heavy body to the earth was found by Newton to involve principles which apply to all we know in mechanical philosophy; in other words, the descent of a tile from a house, or an apple from a tree, arises from the same cause which keeps the moon from leaving her proper course round the earth; and which retains all the planets in their paths round the sun: this principle, or cause, is called by the name of *gravity.* It was known from observation that gravity, or a tendency to approach the earth, belongs generally, to all bodies near its surface; and it was ascertained that it is proportioned to the square of the distance; that is, if a body be attracted by the earth at a certain distance, with a certain force, and be afterwards removed to *twice* the distance, it will now be attracted *not half* as much, but only *one-fourth* as much as it was before; and if it be removed to *three* times the first distance, it will be attracted not *one-third* as much, but only *one-ninth* as much as before, 4 being the square of 2, and 9 the square of 3. From these facts this mighty genius suspected that the same principle might extend to all nature; and thus, by the assistance of a profound geometry, he explained the motions of the heavenly bodies, and demonstrated the system of the world.

That the rules laid down by Bacon had been carefully studied by Newton, is evident from the use he makes of Bacon's phraseology. In his *Principia*, for instance, he gives the same latitude of meaning to the word *axiom* that Bacon does in his *Organon.* Bacon, by this term, means a general principle, obtained by experiment and observation, from which we may safely proceed to reason in all other instances; and Newton gives the name of *axioms* to the *laws of motion*, which of course are ascertained by the scrutiny of nature; he also terms *axioms* those general experimental truths, or *facts*, which form the groundwork of the science of optics. *Axiom*, however, in the language of Euclid, and of mathematicians generally, means a self-evident proposition. Mr. Dugald Stewart thinks that, in this, and other instances, Newton followed Lord Bacon's phraseology "too implicitly." However this may be, it is certain Newton was familiar with Bacon's works.

In the *Chemistry* of modern times, also, we have the most astonishing examples of the success of the inductive, or experimental method. Until

this was employed, no part of science was more fanciful: so that it has justly been remarked, that chemistry, in the middle ages, might be said to have an *elective attraction* for all that was absurd and extravagant in other parts of knowledge. It is true that, before the darkness of these ages had passed away, *Paracelsus* conferred great benefits on the world by the application of chemistry to medicine; and *Van Helmont*, notwithstanding the extravagancies with which his imagination was filled, by the discovery of elastic fluids, did his part to form the new chemistry; but it was the work of those who have had the opportunity of thoroughly imbibing the spirit of the Baconian philosophy, as applied by Newton, effectually to deliver chemistry from quackery and romance; and to frame such a system as that which now exists.

Lord Bacon, in support of the importance of the *inductive* method, lays down the following fundamental principle, as his first and leading *aphorism* concerning the " Interpretation of nature, and man's dominion over it"—a principle which, obvious as it seems, had never been properly acted on by philosophers:—" Man, the servant and interpreter of nature, can only understand and act in proportion as he observes or contemplates the order of nature; more he can neither know nor do." This general principle of Bacon is undoubtedly the foundation of all our real knowledge. The science of the philosopher differs in degree only, *not* in kind, from that information which is the fruit of the commonest experience. Everybody knows that cold produces ice and snow; that the sun is higher in the sky in summer than in winter; that in pits and mines the air sometimes burns, and explodes like gunpowder. Now the moment we depart from these mere facts, and begin to consider their causes, and in what circumstances they are likely to happen again, we begin to apply *experience* to science—we reason by *induction*. It cannot be doubted that this inductive method is, to a certain extent, natural to the mind. The foundation of it lies in our expecting the *same effects from the same causes*; for this is the groundwork of reasoning from particular facts to general, or what is called " *generalisation*." This expectation seems to be an original principle implanted in the human mind by the beneficent Creator; and without which we could know nothing, and never be safe from danger. It goes before experience, and is the guide of it. A child who for the first time approaches too near the flame of any substance that is in a state of combustion, or burning, so as to hurt himself, afterwards proverbially dreads the fire; connecting in his mind the remembrance of the pain he has felt, with the touching of any part of his body with the flame. It is evident he expects the same effect to follow from the same or a similar cause; and the resemblance between the flame of a candle and that of the fire would, it is likely, put him on his guard against a similar disaster from that source also. Now, this is a species of *induction*, though not founded on an enlarged experience; and it is probable the child will now come to have the same fear of everything bearing the appearance of flame. He might expect that the same effect must arise from contact with the flame of *alcohol*, or spirit of wine, for instance, until informed that it was possible to touch this without being burnt. Hence the necessity of a sufficient experience, before we form any general principle.

A remarkable instance of this necessity, and one drawn from the more exact part of science, is mentioned by Euler, in his Memoirs of Berlin. It happens that in the formula $x^2 + x + 41$, if $x$ be made successively equal to 0, 1, 2, 3, 4, 5, etc., the results will be a series of which the first forty terms are all *prime* numbers—that is, numbers which have no divisors, or which cannot be divided into any number of equal integral parts, less than the number of units of which they are composed; hence it might be supposed the law was general;—or, in other words, for the sake of any of our readers who have not made themselves acquainted with algebra, that any number whatever, multiplied by itself, and then added to itself, together with the number 41, would make a prime number. It happens, however, that in the very next, or forty-first term, the result is a *composite* number—that is, a number that can be divided by some smaller number, without a remainder; and thus the rule is false. Now, it is the great design of the *Novum Organum* to point out the method of a strict and enlarged experimental, or inductive reasoning, especially, though by no means exclusively, in reference to the study of *physics*, or natural philosophy. This work may be regarded as a more useful and more extensive system of reasoning than any that went before it; not consisting of *syllogisms* and the modes of argument that were then in use, which, however correct, provided the premises be true, could, after all, only serve for the arrangement of truths already known, or for detecting very obvious and gross fallacies in argument, and for classifying such truths and fallacies, but an art leading to invention, and productive of discoveries of the highest importance to the general uses of human life. These discoveries are proposed to be accomplished by turning our attention from mere words to things themselves; from all those frivolous and childish speculations which only dazzle without illuminating the understanding, to a sober and rational method of investigating the operations and laws of nature,—a method well calculated to recommend itself to those whose only object is *truth*.

Lord Bacon sets out by condemning the two opposite errors, which up to his time had proved equally injurious to a just acquaintance with nature; the one that of magisterially pronouncing on her operations, as if *all* were explored and known, and nothing further were to be discovered; by which supposition all inquiry would of course be prevented as useless; the other error that of the sceptic philosophers, who, proceeding to the opposite extreme, declared that *nothing* can be known, and endeavoured, by distrusting the clearest notices of sense and consciousness, to convince themselves of this absurd and inconsistent notion. Those of the ancient Greeks were more worthy of our imitation, whose writings are now lost, but who seem to have held a middle course; and though they complained of the mystery in which nature often wrapped herself, still kept on their pursuit, and did not allow themselves long to lose sight of their object. Even these philosophers, however, do not appear to have applied a sufficient *rule* and *method* in their inquiries, but placed too much reliance on subtilty of mind, and random conjecture. The art of logic, so much extolled by the ancients, certainly came too late to minds already prepossessed by error; hence, by the perversion of this instrument, the aberrations

of the human understanding were only fixed and rendered permanent, instead of being corrected and removed; the chains of prejudice were rivetted, and loaded with gaudy ornaments. It is evident that the mind needs direction and regulation, by some right method of employing its faculties, as much as the body needs the assistance of the mechanical powers in raising large and heavy weights. In such a method the ancients were altogether deficient. Yet by way of conciliation, Bacon observes that he is still perfectly willing to leave the ancients in possession of all the honour that is due to them. The method of science, however, here proposed, being so little known to them, no room, he conceives, is left for rivalship and envy. He contends not for victory, but for utility and truth. If any persons, from want of time, or other causes, are unable to pursue this more laborious method, he says they may still attempt what they can, by framing systems and theories, which he terms the mode of *anticipation of the mind;* others, who are more worthy sons of science, must follow *his* plan of induction, or *the interpretation of nature*, as it is here laid down, a method on which it is the more necessary to insist, because many examples have occurred since Bacon's time, of the bad consequences of neglecting it. Of this, no less names than *Descartes* and *Leibnitz* were early examples; men endowed with every faculty of the mind that most fits for philosophical investigations—with the happiest genius for science.

The body of the Novum Organum is divided into two general parts. The former of these, which is intended to introduce the latter, is calculated to prepare the mind for receiving and employing the doctrine contained in the second part, which delivers the new method of proceeding in all kinds of inquiries, in order to the acquisition of a more accurate knowledge of the works of nature, and a more extensive dominion over it. As the whole book is quaintly divided into *aphorisms*, or short portions, founded on sententious remarks, and accompanied with illustrations, we shall not attempt to conduct our readers through each of these portions separately, which would be almost to present the whole; but hoping that those who have the opportunity of doing so, will feel induced to read the original work, or a translation of it, for themselves, we shall simply endeavour to condense its principles, and shall throw it into sections adapted to our present purpose.

### I. *General Prefatory Remarks.*

The first thirty-seven aphorisms, which we may call our *first section* of the former part of the work, are chiefly occupied in attempting to remove ancient prejudices, and to procure a fair and candid attention to a book which, at the time of its publication, must have had so much to contend against. It is deplored by Bacon, that for want of a right method of study, little effects had resulted, up to the close of the sixteenth century, from the labours of men engaged in the pursuit of science; for knowledge is the same thing as power, and where there is little sound knowledge of nature, there will be little power gained over her. This must always have been the state of things, unless means before untried had been employed in the improvement of the

sciences. That improvement could not be left to mere accident as heretofore, when each following age only re-echoed the voice of the preceding, and contented itself with pompously extolling the existing delusive methods of philosophy, to the neglect of one more genuine and scientific. The philosophy of nature Bacon compares to "a vast pyramid, which ought to have the history of nature for its basis:" those who strive to erect it by the force of abstract speculation, he likens to the giants of old; who, according to the poets, endeavoured to throw mount Ossa upon Pelion, and Olympus upon Ossa. The only hope on which to found all real advancement in knowledge, must arise from a strict experimental method, that is, the examination of a sufficient number of particular instances on both sides the question at issue, so that when all the exceptions are properly made, some useful and important truth may remain as a principle to proceed on, in further inquiry. When examined on this inductive principle, most of the common notions existing when the *Novum Organum* was written, were quite unsatisfactory: those, for instance, relating to *gravity*, *attraction*, the *elements*, *matter*, *form*—all these, and many more, as taught in the sixteenth century, were but ill-defined and fantastical notions. Even many of our common-sense ideas, as those relating to our sensations and reasonings, though they can scarcely in themselves greatly deceive us, yet may these be much obscured and perplexed by a false mode of philosophizing. For instance, the supposed necessity of the objects of sense being actually present with the mind that perceives them, gave rise to the *notion* of *images*—an image of a horse must be *in* the mind, or the horse could not be seen; whereas, it is evident, that *seeing* is a fact in the nature of man: how the impression is conveyed from the nerves and brain to the mind, we know not.

The mode of searching after truth that had always been in vogue was, at the best, from observing, not very rigidly, a few particulars, to rise at once to some *general* axiom or conclusion; but the only genuine method, Bacon observes, is, to advance gradually from the notices the senses give us in particular instances, and those sufficiently numerous, to some *lesser* axiom or principle, and then gradually to proceed to some still more general principle, till at length you form some grand and final conclusion. The understanding seems but too naturally to adopt the former of these two methods, which is calculated most effectually to prevent all advances in knowledge and science. It is the object of science to see things as they are in nature, and not in appearance merely: but "there is a wide difference," says Lord Bacon, between the *idols* of the human mind, and the *ideas* of the divine mind: that is, between certain vain notions, and the real characters and impressions that are stamped upon the creatures, as they are actually found." We may illustrate this by a reference to the Ptolemaic System of Astronomy, which was founded on the false and hasty notion of the *apparent* motions of the heavenly bodies being the *real* ones. The sun, moon, and stars, seem to move round the earth once in twenty-four hours: hence the rude and gothic notion that the earth was the centre around which they are all actually whirled; whereas, by a successful cultivation of a proper method, the truth is now demonstrated to be that the sun, and not the earth, is the centre

of the mundane system; and is, with respect to the earth at least, nearly at rest. "The method of *anticipating nature*," says Bacon, "rash, hasty, and unphilosophical as it is, has nevertheless a much greater power than the other, to entrap the assent of the mind; which is too apt to be delighted with its own conjectures, and to allow the imagination to be struck and filled with its own plausible subtilties: whereas *interpretations of nature*, or real truths arrived at by induction, being separately and more slowly collected, cannot so suddenly arrest the mind; and when the conclusion actually arrives, it may so oppose prejudice, and appear so paradoxical, as to be in danger of not being received, notwithstanding the evidence that supports it, "like mysteries of faith."

The method of *anticipation*, however, or of dictating to nature what she and her operations are to be, could never, of course, avail to promote real science, whatever talents might be engaged in it. *Tycho Brahe* thus *anticipated* nature, in taking it as a certain truth that the earth must be at rest. For though he was too well acquainted with the planetary motions to suppose their centre any other than the sun, yet in order to preserve his favourite notion that the earth did not move, he supposed the sun, with all the planets, to be carried annually round it; while these latter revolved in their proper orbits round the sun: and having rejected the Copernican doctrine of the daily motion of the earth round its own axis, he was obliged to retain the most violent part of the system of Ptolemy, and to suppose that the whole universe was carried round the earth every day. It was thus, also, that the great *Kepler*, the contemporary of Bacon, imagined that the planets *must* be *six* in number, and must have orbits of certain dimensions, because of certain properties of numbers, and of plane and solid figures, with which he fancied they corresponded. These speculations he published in 1596 in his "*Mystery of the World*;" and on sending a copy of his book to Tycho Brahe, he received from him the advice, "first to lay a solid foundation in *observations*, and then, by ascending from them, to strive to come at the causes of things." To this excellent advice, as Maclaurin observes, we owe Kepler's more solid discoveries: for, availing himself of Tycho Brahe's astronomical observations, he, from them, discovered the laws of the planetary motions, known ever since by his own name. *Huygens*, a celebrated Dutch geometrician and astronomer, and who lived later, suffered himself to be imposed on in a similar way: for, having discovered one of Saturn's moons, this, added to the four moons of Jupiter, and the one belonging to our globe, made up the number six; the number of the primary planets then known being also six; and the number six being a *perfect* number—that is, a number that is equal to the sum of the equal parts into which it can be divided, Huygens affirmed that the number of the planets was complete, and that it was in vain to look for any more: we need not remark that this mystical speculation has since been disproved by fact. Now it was the praise of Lord Bacon to endeavour to remove from men's minds this superstitious tendency to rest in preconceived notions, which so much prevailed, and which was encouraged by some who were greatly his superiors in the abstract sciences. "Though the labours and

capacities of all men," says he, "in all ages, could be united and continued, they could effect no considerable progress in science by *anticipation* of nature; since radical errors in the mind's first digestion are not to be cured by the excellence of its functions, or by any succeeding remedies. Unless men choose to move always in a circle without advancing, we have but one simple method left; namely, that of leading them to particulars, to their order and connection. They must be contented, for a time at least, to forsake their own notions, and to become acquainted with things themselves. Our method has some resemblance to that of the Sceptics at the outset, but differs widely from it, and is directly opposed to it in the end. They foolishly assert that nothing can be known: we say that little is to be expected from the existing method; they contradict reason and common sense; we endeavour to assist both."

II. *The Idols of the Mind; or Grand Sources of Prejudice.*

Lord Bacon philosophically points out, with great exactness, various general sources of those *errors* which men are apt to commit in forming their notions of things; and he shows how very great an obstacle they form to the progress of our knowledge, and the acquisition of truth. "The *Idols*, or false notions of the mind," he says, "so deeply fix themselves in it, that they not only shut up the avenues through which truth might enter; but even when it has entered, they will again be presenting themselves, and will be troublesome in the advancement of the sciences, unless men, being aware of them before hand, guard against them with all possible diligence." As no part of Bacon's works is more valuable than this, or more important to all who are in pursuit of knowledge and truth, we shall give some detail of it to our readers. He strikingly, though in his usual quaint style, calls the prejudices that check the progress of truth, by the name of *Idols*, because mankind are apt to pay homage to these, instead of regarding truth; as they have offered to imaginary deities, the worship which is due only to the true God.

These prejudices and prepossessions are divided into four classes, which are called *Idols* of the *Tribe; Idols* of the *Den; Idols* of the *Market;* and *Idols* of the *Theatre.* These sources of error are peculiarly deserving of notice, because they will be found, if we mistake not, to include the principal causes, which in all cases have a tendency to obstruct the pursuit of truth, whether natural or moral. They constitute a sort of infection from which the mind must be purified, before it can enter with soundness and vigour, and with the best effect, into any sort of inquiry which has truth, and truth only, for its object. "While the rules Lord Bacon gives us," says the late Dr. Thomas Brown, "are rules of physical investigation, the temple which he purified was not that of nature itself, but the temple of the mind; in its inmost sanctuaries were all the idols which he overthrew; and it was not till these were removed that Truth would deign to unveil herself to adoration."

1. The *Idola Tribus*, or the *Idols* of the Tribe, the *first* class of prejudices, are so called because they are common to the whole *tribe*, or *race* of mankind; they are, in fact, *those general prejudices which arise*

*from the infirmity of human nature itself.* "The understanding of man," says our author, "is like a mirror whose surface is not true, and so, mixing its own imperfection with the nature of things, distorts and perverts them." For instance, there is a tendency in the mind to suppose a greater *uniformity* in Nature than she actually possesses. We are always disposed to imagine parallels, correspondencies, and relations that may not actually exist. Hence the supposition that the heavenly bodies must all move in perfect circles, because the orbits of the planets were perceived to return into themselves: this was universally believed by the old astronomers, till Kepler disproved it a few years before Bacon wrote, by showing that the planets move in elliptical or oval orbits. Hence the ancient notion that the element of fire, with its *orb*, must be added to air, earth, and water, to make up the *even number* of what they called the *four elements.* Bacon's prediction that the sources of error would return and be likely to mingle with science even in its most flourishing condition, has been verified with respect to this particular illusion, in the case of sciences which in his time were scarcely in existence. When it was found that a considerable part of the earth's surface consisted of minerals, disposed in horizontal strata, or layers, it was immediately concluded that the whole exterior surface either is or has been composed of such layers; and on this assumed principle entire theories of the earth have been constructed.

Again, the mind has a wonderful facility also of being imposed on by *prepossessions.* If once pleased with any notion, it immediately endeavours to make every thing agree with this, even in the face of evidence to the contrary. It gets over opposing instances and examples, either by altogether neglecting them, or by inventing some subtil distinction which shall still maintain the favourite principle with which it first set out. Dreams, omens, and astrological predictions are cases of this kind, in which the instances of failure are passed over by the superstitious with little notice, while those instances in which the event corresponds to the supposed preternatural intimation of it are carefully remembered. This prepossession of the mind cannot endure exceptions to rules, and negative instances; though these are, in fact, of the greatest importance in establishing axioms or general principles.

The *imagination*, also, is apt to be overpowered with whatever at once strikes and seems to fill it; and the mind, imperceptibly yielding to this impression, readily comes to some conclusion, not waiting for the gradual processes of the understanding, to try general principles by the test of various, remote, and dissimilar instances; which can never be done without following rigid rules, and submitting the faculties to violent restraints.

The *restless activity* of the human powers, moreover, aids the force of general prejudices. The mind is ambitious of understanding what is incomprehensible. It attempts to grasp what is beyond its power, instead of being content with some proper resting-place for the natural weakness and limitation of its faculties. It wearies itself in its endeavour to comprehend such ideas as *space*, *time*, *eternity*, *infinity;* and it is still more apt to be misled, Bacon thinks, by its desire to discover the *final causes* of things, that is, the *uses*,

or *ends*, which the Creator had in view in forming them. The phrase *final cause* was first introduced by Aristotle, and the inclusion of this among *causes* in general as objects of inquiry, had the effect of diverting such minds as those of his followers from the study of nature to mere speculations. We must therefore remember that the hint which Bacon here throws out on this subject, and what he says more on it in his other works, always has a reference to *final causes* as treated by the Schoolmen. He objects to these being included, as a branch of *natural* science; but it cannot be supposed that his remarks on this subject arose from the same source which produced the prejudice against final causes that so generally prevailed in France in the eighteenth century. Bacon had no bias towards atheism: he censures Aristotle for "substituting Nature instead of God, as the fountain of *final causes;* and for treating them rather as subservient to logic than theology;" and in his Essays he finely remarks, "I had rather believe all the fables in the Legend, and the Talmud, and the Alcoran, than that this universal frame is without a mind. While the mind of man looketh at second causes scattered, it may sometimes rest in them, and go no farther; but when it beholdeth the chain of them confederate and linked together, it must needs fly to Providence and Deity."

Notwithstanding Lord Bacon's objection to final causes as a subject of philosophical inquiry, it must be allowed that, apart from the charm which the final causes, or ends of things, lend to Nature, when they are satisfactorily perceived, which is the moral use of them, there are some cases in which a consideration of them has conduced to actual discoveries in science. It was noticing the situation of the valves in the veins of the animal body, for instance, that led to the great discovery of the circulation of the blood. Harvey, who was its author, perceived that these valves, in some parts of the body, were so placed as to give a free passage to the blood towards the heart, and to exclude its return the same way. He thought there must be some particular *design* in this, and no design appeared more probable than that, since the blood could not well, because of the interposing valves, be sent by the veins to the limbs, it should be sent through the arteries, and return through the veins, whose valves did not oppose its course that way. This fact, however, and others which might be mentioned in illustration of this subject, were not known to Bacon; and the great abuse of the speculation on final causes by the Schoolmen not unnaturally led him to an unreasonable distrust of it.

The *influence of the will and affections on the understanding*, or what may be termed the *moral* state of the mind, may also greatly affect our opinions. "The light of the understanding," says our author, "is not a dry or pure light, but it receives a tincture from the will and the affections, and forms the sciences accordingly; for men are most willing to believe what they most desire." Hence, he observes, "difficulties are rejected through impatience; the deeper things of Nature are dreaded through a certain awe; experience is discarded through pride; truth when it limits our hopes; paradox is shunned through fear of vulgar opposition; and thus in innumerable ways, and often imperceptibly, do the affections and passions tinge the understanding with their own colouring."

The *fallacy and incompetency of the senses* are an additional

source of mistake and error. Inquiry commonly ends in what is seen on the mere surface of things, while the organization, the texture, or the inward changes of bodies are unknown. On these, however, chemistry depends." Lord Bacon considers this incompetency and dulness of the senses as one of the greatest impediments to an exact knowledge of nature. "Nor can instruments," he adds, "here be of any great service, since all true interpretations of nature must be made by suitable and proper trials, in which the senses judge of experiment only, and experiment is the judge of nature and fact." He complains, by way of example, that in his time even the properties of the common air of the atmosphere, and of all the agents, still more subtil than the air itself, of which he supposed there might be many, were almost entirely unknown. What would he have said, could he have witnessed the application of the inductive philosophy to the discovery of the properties of the various kinds of *gases*—the researches of Newton respecting *light*—the experiments of Franklin in *electricity*—the powerful agency of *galvanism*, which has produced new creations in chemistry, and changed the whole face of that interesting and useful science!

Lastly, there is a tendency in the mind to *abstraction or generalisation*, which should be carefully watched as a likely source of error. It is less troublesome to reason upon fancied general notions, than to make experiments. "But Nature," says our author, "must be anatomized rather than abstracted: matter should be considered in all its states and transformations; so ought motion and its laws; but for the Aristotelian abstract *forms*, they are *idols* or *figments* of the mind."—These seven particular causes, then, may be borne in mind as among the chief general prejudices, which are apt, often insensibly, to militate against the discovery of truth, and the advancement of science: too great a tendency to suppose a *perfect uniformity* in nature; *hasty prepossessions* in respect to some *favourite idea;* the influence of the *imagination;* the *restless activity* of the human mind; the bias the *will and affections* give to the judgment; the *imperfection* of the *organs of sense;* and the love of *abstractions and generalisations.*

2. The *second* class of prejudices introduced by this sagacious observer of human nature, as tending to obstruct the progress of truth and knowledge of all kinds, he terms *Idola Specus*—Idols of the *Cave* or *Den:* that is, *those prejudices which stamp upon each mind its own peculiar character, and are identified with every individual man.* "Idols of the den," says the *Novum Organum*, "are the idols of each particular person; for in addition to the general waywardness of human nature, every man has his own peculiar *den* or *cavern*, which breaks and corrupts the light of nature,—either on account of his constitution and disposition of mind—his education and the society he keeps—his course of reading and the authorities he most respects—his peculiar impressions as they may be made on a mind that is pre-occupied and prepossessed, or is in a calm and unbiassed frame: so that the human spirit, as it is differently disposed in different individuals, is a thing fluctuating, disorderly, and almost accidental. Hence Heraclitus well observes that men seek the sciences in their lesser worlds, and not in the great and common world of nature." In another place, these idols of the den are spoken of in the figurative language of Bacon, as "each man's

particular demon, or seducing familiar spirit;" and again, every mind is compared to "a glass, with its surface differently cut, so as differently to receive, reflect, and refract the rays of light that fall upon it."

Some of these private prejudices he justly regards as requiring peculiar caution, because they possess the greatest tendency to pervert the mind. The *particular studies*, for instance, to which a person has been addicted—more especially, if he has any claim to be an inventor, may warp his judgment in other pursuits, and tend to corrupt his notions. It was in this way that Aristotle, through his fondness for distinctions and quiddities, made his natural philosophy a mere slave to his logic, and so rendered it little else than a useless source of disputation. *Gilbert*, of Colchester, is another example. In his "*Treatise on the Magnet*," he gives a specimen of experimental inquiry carried on with considerable correctness and success; but he tried to make his magnetism a general principle, considering it to pervade all Nature. It is but fair to acknowledge his merit however, for "to him," as Dr. Priestley observes, "we owe a great augmentation of the list of electrical bodies, and of the bodies on which electrics can act: though his theory on this subject is imperfect, he may justly be called the father of modern electricity." Of late years, this species of fondness for theory has been discovered in attempts to account for the motion of the planets by electricity; and electricity and galvanism together have been employed to explain gravitation, the affinities of chemistry, and even the laws of vegetable and animal life. At an earlier period Des Cartes, after Bacon had so well written against theories, endeavoured, in medicine, to combine Van Helmont's doctrine of *fermentation* with his own beloved notions respecting *vortices;* which he thus brought down from heaven (where, as he supposed, they guided the planets in their orbits) to earth, in order to explain the chief functions of the animal body. Hence he formed a chemico-mechanical system of medicine which was eagerly received by the Dutch physicians of his time. Thus may one favourite pursuit be suffered to give a tincture to every other branch of knowledge, and to corrupt it. "The tribe of chemists," says Bacon, "have constructed a fantastical philosophy from a few experiments of the furnace." None certainly of the professed inquirers after truth, up to his time, were ever more extravagant and fanciful than the experimenters in chemistry; witness the Archæus of Van Helmont, and his army of spiritual agents, derived from the elastic fluids.

Among the private prejudices or the sources of error arising from the mental constitution of individuals, the natural *difference of men's capacities* is enumerated. Some minds, Lord Bacon thinks, are fitted more for discrimination, while others content themselves with merely noticing resemblances. "The great and radical difference of men's capacities," he says, "as to philosophy and the sciences, lies in this, that some are stronger and more fitted to observe the differences of things, and others to observe their correspondences: for a steady and sharp genius can fix its contemplations, and dwell and fasten upon all the subtilty of differences; whilst a sublime and ready genius perceives and compares the smallest and most general agreements of things. Both minds easily fall into excess, by grasping either at the dividing scale or the shadows of things."

With greater clearness and perspicuity, he adds to these personal

prejudices and tendencies, the *attachment to times,* in forming our ideas of truth and excellence. Some men have cherished an idolatrous admiration of the ancients; and have scarcely allowed even a comparison to be made between their works, and the monuments of modern genius. Thus the poetry of Milton has been underrated by those who have been so devoted to the remains of classical antiquity, as to be almost incapable of awarding due merit to productions in the vulgar tongue: witness the contests respecting the superiority of ancient or modern learning. On the other hand, while every thing modern has been despised only because it is not ancient, some have been misled by the opposite cast of mind, and have been inflamed with a constant passion for novelty; being disposed to yield little or no respect to antiquity, even where the experience of past ages might be of great service to us. This kind of prejudice has greatly declined, however, since Bacon's time—*truth,* and not the establishment of sects, having happily become the leading object of philosophical inquiries; "for truth," says he, "is not to be derived from any felicity of times, which is an uncertain thing, but from the light of nature and experience, which is eternal."

He exemplifies another kind of *particular* prejudices, or of the *Idola Specus,* by comparing the school of Leucippus and Democritus, among the ancients, to the "other philosophies," alluding probably to those of Pythagoras, and of Socrates, Plato, and the Academics. Leucippus, Democritus, and Epicurus were *atomists,*—they taught that the whole universe is composed of either *atoms* or a *vacuum,* and that it was by the accidental meeting together of these atoms that the world assumed its present form and appearance. "This school," says Bacon, "is so taken up with the particles of things, as almost to neglect their structure; whilst the other views the fabrication of things with such astonishment, as not to attend to the simplicity of nature;" referring to the lofty speculations and flights of imagination that characterized the Platonic school. "To contemplate nature and bodies in their simple elements," he quaintly remarks, "breaks and grinds the understanding; and to consider them in their configurations and compositions blunts and relaxes it." This *exclusive predilection for the minute or the vast* in nature, by which some of the ancient schools were marked, much resembles the second order of prejudices which is mentioned under this class. "In this manner, then," concludes the account of these prejudices, "let contemplative wisdom proceed in dislodging and chasing away the *idols* of the *den,* which principally have their rise from *prevalent studies; excess of composition and division; affections for times;* and from the *great or small size of objects.*"

3. Another class of prejudices to be carefully avoided in our inquiries after *truth,* are termed, in the figurative but expressive language of Lord Bacon, *Idola Fori; Idols of the Market-place;* that is, *prejudices arising from mere words and terms in our common intercourse with mankind:* they proceed, in short, from the *imperfection of language.* These prejudices he pronounces "the most troublesome of all." "Words," says he, "are for the most part accommodated to the notions of the vulgar, and they define things by bounds that are most obvious to common minds; and when a more acute understanding, or a more accurate observation, would remove these boundaries, and

place them more according to nature, words *cry out and forbid.*" A familiar instance of this may be taken from our common mode of speech with regard to the heavenly bodies. We say of the *sun*, that it *rises* and *sets*, though every one, but the most ignorant, is aware that this is not strictly true, since the sun is stationary with regard to the planetary system; its *apparent* motion being owing to the *real* motion of the earth. In this instance, however, the delusion which words might produce, is obviated by the popular knowledge of astronomy which prevails. In many cases it is certain that the want of accuracy in the use of words and phrases has proved a great barrier to the pursuit and attainment of truth. How many violent disputes have there been, for instance, on *liberty* and *necessity* among ethical writers, while neither party has taken the pains first to say what he meant by these words; which might have saved both much time and much angry contention. Hence, in order to avoid controversies respecting mere words and terms, it is recommended to begin with these according to the "wise method of the mathematicians," and to reduce them to order and certainty by *definitions.* "Yet," it is justly observed, "these definitions themselves cannot wholly remedy the evil; for definitions consist of words, and words produce words; so that recourse must be had to particular instances."

Lord Bacon's meaning may be illustrated by such words as *sensation*, *will*, *benevolence.* We may define sensation, and say it is *feeling*, but what is *feeling?* What, for instance, is the feeling or sensation of *cold?* What is the sensation of *seeing?* None can describe these, it is obvious, to a person supposed never to have experienced them. *Will* may be defined *volition*, but this again is a mere translation; and if an intelligent being could be imagined who had never actually *willed any thing*, nor ever had any *desire* in his mind to do or say any thing, it would be utterly impossible to make him understand what *willing* is. A being of simple malevolence, or one who had never felt towards other beings any thing but *hatred*, could have no idea of the emotion of *benevolence* towards others: he could not know what it is to love them. But when a child once understands that *sensation* is a general name for all those immediate effects which arise from objects acting upon any of the organs of sense—a name for *seeing*, *hearing*, *smelling*, *tasting*, and *feeling* indifferently; when he learns that *willing* is that state of the mind which directly goes before any deliberate action; or that *benevolence* or *love* is a term expressing certain natural and delightful emotions towards his parents, brothers, sisters, and friends,—he then understands the meaning of these words by instances and examples. Or, if I wished to convey to the mind of another person the meaning of the word *gravitation*, or *attraction*, as it is employed in the Newtonian philosophy, instead of merely saying it is the *tendency* bodies have *towards each other*, I might state the simple fact, and say, when a body is let fall from any height it proceeds invariably to the earth, and more swiftly in proportion as it arrives nearer the surface: this is what is meant by saying that the body is *attracted*, or *gravitates* with accelerated velocity toward the earth: and when the inquirer is further informed that the earth itself also proceeds, however little, toward the falling body; and that the sun, moon, earth, and planets, all mutually move toward each other, more or less, in the same man-

ner, the general idea of what is intended by attraction or gravitation is gained; and it is understood simply to be a name for a certain *fact*, or *law* in the operations of nature, or rather of nature's Divine and Almighty Architect.

Mankind are apt to be led into errors by words in *two* principal *ways;* and first by the names of *things* which have *no existence* whatever. Of this kind, says Lord Bacon, are such as "fortune, the primum mobile, orbs of the planets, the element of fire, and the like figments which arise from false and imaginary theories." It is almost unnecessary to remind our readers that all such words as *chance, fortune, luck*, etc., are only names for human ignorance of a cause; and that in all the cases in which these words are applied to any kind of circumstances that occur either in the natural or moral world, there is the same necessity for supposing an agency of the Deity as in the greatest, and, to us, most certain events. *Primum mobile*, or the first mover, in Ptolemy's astronomy, was a supposed immense sphere, or hollow globe, which included within it all the spheres, or *orbs of the planets*, and fixed stars, and turned itself and all these round the earth in twenty-four hours! Idols of this kind, however, it is observed, are the more easily dislodged from the mind, because the direct remedy for them is the constant rejection of all mere theory.

But there is another species of delusion which may arise from words, that is likely to produce greater perplexity, and is avoided with greater difficulty. This delusion is produced *when words do not agree* to the *things* they are intended to signify, but are confused and ill-defined. Bacon adduces the various meanings that were formerly given to the word *humidum*, or *moisture*, as an example of this uncertainty: he shows that, according to the vague manner in which the word was used, it would apply to the most dissimilar things, and that *flame*, and *small dust* or *powder*, and *glass*, might all, on this principle, be said to possess *moisture*. It is evident that this uncertainty in the application of the term *humidity* or the quality of *moisture* arose from not considering moisture as a *relative* idea. For instance, quicksilver, with relation to some substances, as our hands or our clothes, is *not humid*, but it may be regarded so with reference to tin, lead, or gold; for it will adhere to their surfaces and render them soft and moist. Even water does not wet all things, for it runs off in round drops from the leaves of many plants, the feathers of birds, etc.; so that water itself is no more moist with regard to these, than quicksilver is with regard to our hands; unless by moisture we mean soaking with water merely. Our great philosopher complains that, in general, the notions of *quality* in bodies, were in his time exceedingly confused. Such were the notions of *gravity, density, tenuity, levity*. From what we know, indeed, of the philosophism which then prevailed, all attempts to reason on these terms must have been like grasping a shadow or beating the air. The words used to express the *changes* which bodies undergo, were also extremely vague and undefined, as *generation, corruption, alteration*. So likewise general names of substances, as *earth;* and *air*, or vapour. It was reserved for the science of modern times to use a more precise language, and to aspire at a magnanimity almost unknown to the ancients—that of frankly acknowledging man's ignorance, and the limitation of his faculties, rather than taking refuge

in the darkness of an ambiguous phraseology. Our readers will perceive from all that has been said, how much accuracy and precision of language depend on the advancement of science; indeed they mutually promote each other. What has been effected in chemistry by a reformation in the use of terms is well known. An imitation of this precision, so far as the nature of the given subject will allow, must lie at the root of advancement, not only in natural, but equally in moral and intellectual science; and here, as in chemistry itself, the advice of Bergman to Morveau will advantageously apply: "In reforming the nomenclature, spare no word that is improper."

4. The last general sources of prejudice adduced, as obstructing philosophical discoveries, are what are termed *Idola Theatri;* Idols of the Theatre; or the *prejudices and perversions of the mind arising from the fabulous and visionary theories and the romantic philosophies* that so long prevailed in the world. "We call them Idols of the Theatre," says Bacon, "because all the systems of philosophy that have been hitherto invented, or received, are but so many stage-plays which have exhibited nothing but fictitious and theatrical worlds; and there may still be invented and dressed up numberless other fables of the like kind." Of this last remark, *Hutchinsonianism* may, in modern times, be regarded as an example, in common with all other speculations that have been opposed to the Newtonian theory of gravitation; and which will be found equally opposed to the method of science here recommended. It was strange that, in the eighteenth century, in the full blaze of that light which was, as it were, *latent* in the Baconian philosophy, and which Newton had struck out—a system, not unlike that of the *vortices* of Des Cartes, should offer once more to darken the heavens, after they had been so effectually purified from the *atoms* and the *plenums*, the *orbs* and the *cycles* of an imaginary astronomy: this, however, is but an example of the power which one favourite notion can exercise over an acute and ardent mind; for Hutchinson assumed, as the basis of his theory, that Divine Revelation was designed to teach men philosophy as well as religion; and in the Mosaic account of the creation, he fancied he saw the physics of the true astronomy. His system, however, which may be considered as a kind of physico-theological romance, has been permitted to sink into its merited oblivion, while Revelation is now regarded as confined to its own sublime and proper province of making known the will of God to man, as to his conduct here, and the way of attaining felicity hereafter. The Newtonian philosophy cannot, on any consistent principles, be regarded as at variance with the communications of the Bible; and, founded as it is on the basis of *demonstration*, it cannot fail to stand the test of time. Gratuitous theories may impose on the imagination, like the *mirage* of the Egyptian sands; but, like this illusion, they must pass away: they may present to the eye a magnificence as gaudy and seducing as the *fata morgana*, sometimes witnessed on the coast of Calabria, in which the most beauteous landscapes, crowned with picturesque villages, superb palaces, and massy towers, seem to possess a real existence: all, however, is only suspended in the air, and the enchanted scene changes with the least shifting of the light, or the ruffling of the sea, melting away like a dream of the night—so must vanish at last all systems of philosophy and science that are not

founded on the solid basis of that *induction,* which it is the design of the *Novum Organum* to explain.

This source of error and prejudice, or the *Idols of the Theatre,* are more especially to be marked as closely connected with the *authority of great names;* and thus, not unfrequently, enslaving the understanding to an ignoble bondage, by what the schoolmen term *argumentum ad verecundiam,* or the argument addressed to the modesty of human nature. Prejudices of this kind stand on a different footing from the former three sources, and are perhaps the most remarkable instances of intellectual slavery. " For," says Lord Bacon, " the idols of the theatre are neither innate, nor are they secretly insinuated into the understanding, but are plainly forced upon it, and are received from fabulous theories and *false* laws of demonstration." The importance of returning to an independent and scientific method of inquiry, or, in other words, of thinking for ourselves, is urged by our author from the fact, that " a cripple in the right way may beat a racer in the wrong." The more vigorous, indeed, the mind is, which sets out in a wrong course, the further does it depart from the goal of truth and science. The method, however, which is here proposed, is adapted not merely to a subtil understanding, and a sublime order of faculties, but is level to the capacities of all, even the humblest. To draw a straight line, or to describe an exact circle, with the unassisted hand, might be a thing scarcely to be accomplished with certainty, whilst it is an easy task to do it by the help of a ruler and compasses, with the greatest accuracy. " All these idols," says Bacon, " are solemnly and for ever to be renounced, and the understanding must be thoroughly cleared and purged of them; for the kingdom of man, which is founded in the sciences, cannot be entered otherwise than the kingdom of God—that is, in the condition of a little child."—In further illustration of these prejudices, *some notice* is proposed to be taken of the *sects* and *kinds* of these false theories; of their *outward signs and indications;* of the *causes* of this so great disadvantage to science; and of the reasons of so lasting and general a consent in error.

### III. *Different Kinds of false Systems of Philosophy.*

The next topic of the *Novum Organum* relates to the *different philosophical theories* which have given rise to the last of the four classes of prejudices; or the *Idols of the Theatre.* Fanciful and imaginary systems of philosophy derive no small charm, it is well observed, from their being so highly wrought: thus, to many, the fictitious drama is more attractive than true history. Lord Bacon divides these visionary systems into *three* general kinds—*sophistical, empirical,* and *superstitious.*

*Sophistical* philosophies, so called from their deceitful pretences, are those formed on careless and hasty observations and experiments, and filled up by the mind of the inventor at his own pleasure. Of this kind Aristotle's philosophy is a very eminent instance, among the other ancient systems, which were chiefly of the sophistical kind. Even the *similar particles* of Anaxagoras, the *atoms* of Leucippus and Democritus, the *heaven and earth* of Parmenides, and other *first principles* of the different sects of Greece, with all their incongruity, at

least savour somewhat of natural philosophy and experience: but Aristotle, both in his Physics and Metaphysics, utters little else than mere logical terms. Even in some of his other writings, where he makes greater use of experiment and observation, he appears to have passed a previous judgment on nature, and attempts to lead experience itself captive to his own opinions and his own humour: he forms a world of *categories* and *predicaments;* accounts for nature's varied operations by the scholastic distinction of *act* and *power;* asserts that there is but *one proper motion* in all bodies; and imposes numerous other fictions on mankind, which are sources of disputation rather than of truth.

*Empirical* systems are those formed upon a *few experiments only,* though these may be made with great exactness. The ancient chemists are adduced as examples, in their idle speculations on the four elements, founded on a few repeated experiments of the furnace. William Gilbert, who lived in Lord Bacon's time, and framed, as we have remarked, a system of philosophy on his experiments in magnetism, was a notable instance of this kind.

*Superstitious* systems are those in which certain philosophical theories are blended with religion, and the one is made subservient to the other. Of these the philosophies of Pythagoras and Plato are specimens; their theories being principally derived from their speculations on the nature and attributes of the Deity. Some theories of the earth in modern times may come under this denomination; and perhaps there is no more signal instance of this kind than the philosophy of Mr. Hutchinson, which we have noticed above. "This vanity," says Bacon, "of mixing things divine with things human is rather to be suppressed, as from it arise not only phantastical philosophies, but heretical religions."

In framing theories, the mind, it is observed, should be especially on its guard against two excesses, that of *dogmatism* on the one hand, and *scepticism* on the other, as these both tend to perpetuate prejudices, scarcely allowing the opportunity of their removal. Thus Aristotle, in order to cut off all occasion of doubting, invented questions, and resolved them at his pleasure, as if he were the arbiter and final judge of nature; while Pyrrho and his followers, on the contrary, doubted of every thing, which was an abuse of the school of Plato, where the sceptic method was first introduced by way of jest and irony, to oppose the more ancient dogmatists. The former of these methods, or that of positively dogmatising, cannot but contract and degrade the mind, while the other must cast it into languishment and despair of ever finding the truth.

All these *Idols* of the mind which have now been noticed, have moreover been greatly defended and strengthened by false *proofs* and *corrupt demonstrations.* Words have been the tyrants of thoughts, and thoughts the slaves of a conceited logic, which has been associated with erroneous and hasty impressions from the senses—ill-formed notions arising from these impressions, and faulty induction, or such a method of establishing general principles, as has been the parent of all error, and the destruction of all the dignity and advancement of science. Thus it was that Gilbert limited his experimental inquiries to the loadstone; and the early chemists and their followers were

perpetually employed in the single art of *alchemy*. This word means the knowledge of the *substance*, or *composition* of any thing: and the two leading objects of the *alchemists* were, the change of the common into the precious metals, or gold and silver; and the discovery of a universal medicine — some elixir of immortality which they fondly hoped would annihilate disease, and prevent the irrevocable doom of humanity, death!

### IV. *Characteristics of false Systems.*

Lord Bacon next gives some *intimations, or signs by which false theories and systems of philosophy may be known*, so as to prevent the impositions likely to arise from them.—One is, the *origin* from which a system of philosophy is derived; which, if it be false and erroneous, whatever immediately arises from it must of course be so too. The sciences existing in the time when the *Novum Organum* was written, were almost wholly derived from the Greeks, whose philosophy, as we have seen, was chiefly of the dogmatic and disputatious kind. This was the characteristic, generally, of their several schools; the writings of the more ancient of the Greeks, who opened no schools, having been lost in the lapse of time, such as those of *Empedocles*, *Anaxagoras*, *Leucippus*, etc., who applied themselves to philosophy with greater simplicity, and with less affectation and conceit, than their successors. The *source* of the existing philosophy was, therefore, corrupt.

If any indications may be gathered from the *times* in which the ancient theories were framed, no great good, it is further argued, could be expected from these. In the ages of the Grecian philosophy, the field of observation and experience was limited by the little knowledge the ancients possessed of the habitable world. Their history, also, of past events, and of the origin of nations, was to a great degree fabulous. They considered many regions uninhabitable where great nations have been since found to exist. Their travels were extremely circumscribed, and the art of navigation was exceedingly imperfect.

If, moreover, we judge from the actual *effects* of the Grecian philosophy, very little can be shown to have resulted from it tending to improve the condition of mankind, during the space of so many ages. Something, indeed, may have accrued from the pursuit of chemistry among the ancients and their followers: but this has rather happened by accident than been produced by design; for all their theories were injurious to the discovery of truth. The cultivators of the magic arts, too, in their jugglery, have stumbled on some few matters; but even these have been corrupted by imposture. The *alchemists*, however, Lord Bacon allows, made not a few useful discoveries while vainly pursuing their chimerical and visionary projects. We are indebted to their labour and perseverance for the method of preparing alcohol, aqua-fortis, vitriolic acid, volatile alkali, gunpowder, and a variety of other chemical compounds.

Another test of truth in philosophical systems may be derived from their *progress* and improvement: but, up to the seventeenth century, that is, for two thousand years, the sciences had been nearly stationary; or rather they flourished most in the remotest ages, and afterwards declined. Witness the decay of the Pythagorean astronomy till the time of Copernicus.

Again, the *confession of the authors* themselves of the systems that had prevailed may be regarded as a testimony of the strongest kind to the vanity and inefficiency of these theories; for while these men pronounced on nature with the utmost confidence and dogmatism, we may detect them at intervals assuming a desponding air, and complaining of the obscurity and uncertainty of all things. Hence arose the school of the *Academic* philosophers, who doubted of everything, and consigned mankind to the eternal darkness of a sceptical ignorance.

The great *disagreement* and *opposition*, moreover, that existed among the ancients, shows, says Bacon, that "the avenues from sense to reason were not well guarded, since the one subject of philosophy was so rent and split into error, that nothing remained fixed and stable in the existing notions derived from the Greeks; nor was there any certain rule of investigation."

The opinion, also, that was entertained in the sixteenth century, that a *general consent* prevailed in the philosophy of Aristotle, was a *fallacious* argument of its truth; for the prevalence of the doctrines of Aristotle and Plato was greatly owing to the accidental circumstance of their being preserved from the general wreck of human learning, which ensued on the irruption of the barbarous nations into the Roman empire. Besides, such a consent as that which is supposed, if proved to be ever so little founded on accident, would better deserve the name of *obsequiousness;* not being the result of a free exercise of men's judgments, all centering at last in the same conclusion, but the offspring, as it is evident, of prejudice, and an abject vassalage to the authority of names.—The character, therefore, of the systems of science and philosophy that had been current, was extremely unfavourable to the supposition of their truth, whether taken from their *origin*, their *fruits*, their *progress*, the *confessions* of their authors, or from *general consent.*

## V. *Causes of Error in Philosophy.*

The next topic of the *Novum Organum*, and the *fifth* convenient section into which the former part of the work may be divided, relates to the *causes of error* in philosophical inquiry.

The first cause assigned by our illustrious author is, the *short space of time* which, notwithstanding the lapse of so many ages, had been at all productive in the discoveries of science. He beautifully compares duration to space, and places before us the emblem of a barren desert, as a fit representation of that lasting sterility which had reigned over the tracts of time. Scarcely six of all the centuries preceding the age in which he lived could be regarded as, in any degree, exceptions to this general winter of the human mind. The middle ages were proverbially periods of gross and palpable darkness. Men of leisure were found shut up in the gloom of monasteries; and rarely did a ray of genius emerge from these cloistered solitudes, and find its way into the theatre of human life, so as to improve and embellish it with inventions like those which have, in our happier times, rendered it a scene of ever new and increasing wonders.

Even at the best, the comparative *neglect* of the philosophy of *nature*, properly so called, may be regarded as another source of

the slumber of the human intellect, and of its inefficiency in attaining to anything like a just method of science. The sublimest geniuses, allured by gain, or by the love of speculation, exhausted their energies in the disputes of a scholastic theology; or, at a more early period, among the Romans, were almost wholly devoted to politics. Mathematical and natural science, the parents of all mental discipline, had lost the footing they had obtained among the remoter Greeks, almost from the time of *Thales;* and even the great moralist, *Socrates*, had contributed, in a considerable degree, to turn away men's minds from the contemplation of nature. Thus the most definite and tangible sources of our knowledge—those which are peculiarly adapted to fix and regulate the operations of the mind, by perpetually recalling its attention to what is seen, and felt, and heard, were abandoned; and the human imagination was suffered to roam in a shadowy and aërial region, amid a scenery that was not nature's creation, but its own.

Again, where some taste for the study of nature herself *did* exist, scarcely one single individual was found to devote himself *wholly* to this pursuit. Nature was still not sought for her own sake, but was made the handmaid of some profession; and to this she was enslaved. Nature was not regarded as the parent of the sciences; and these, by standing too much alone, resembled the branches of a tree attempted to be kept alive separated from the root and the trunk.

The *true end* of science also was *mistaken*, "which," says Bacon, "is to enrich human life with useful arts and inventions;" and philosophers had made it their chief object to be at the head of sects; to aggrandize their own fame; to gain dominion over the minds of men; or to obtain some other exclusively selfish end. Almost every kind of inferior aim was by turns the lord of the ascendant, while *truth*, immutable, unalterable truth, loved and sought for its own sake, was eclipsed, or cast into the shade.

Besides, had the end itself been right, yet the *method was wrong*. As this is the main drift of the first part of the *Novum Organum*, we can scarcely insist on it too much, since nothing is more important here than to remember, that so long as any gross impropriety exists in the *manner* of investigating truth, the most strenuous labour must be in vain. All things were left, as it is strongly expressed, " to the darkness of tradition ; the giddy agitation and whirlwind of argument; the waves and windings of accident; and a vague, uninformed experience." The first inquiry had always been, to know what others had said and thought on the given subject. This was usually received, and to it were added the vagaries of the inquirer himself. Such a method could, of course, only propagate and perpetuate error; and in such a state of things truth still remained shut up as in a labyrinth.

*The blind reverence for antiquity*, also, which had possessed the minds of men, and the devotedness which existed to great names, well accorded with the feeble efforts of the human intellect, and formed a striking feature in the reign of darkness. The assertion of a philosopher was almost the only specific against error, and the chief support of truth: whereas, observes Lord Bacon, " truth is justly to be called the daughter, not of authority, but of time;" in other words, time and patience alone can furnish the opportunity of that observation and experiment on which knowledge must be legitimately founded. The argument

addressed to human modesty, as the logicians termed it, was, however, often received with a kind of religious awe, even when the proposition affirmed, if, indeed, understood at all, was revolting to common sense. It certainly ought to be no subject of complaint, that this is the peculiar delinquency of the age in which we live. Even the overpowering genius of Newton has not preserved his theory from opposition in very recent times—an opposition, nevertheless, only to be viewed as the result of that most desirable freedom of inquiry, which was almost unknown to the ancients, and which can, at no period, issue in anything but the additional, or, we might say, the superfluous, confirmation of the Newtonian philosophy. To believe without examination, however it may accord with our natural indolence, is unworthy of the mind of man. In such an assent, its noblest powers are more than dormant and useless: they contract, if we may so say, by every such repetition of what is not worthy to be called *belief*, a sort of rust and stiffness, that unfits them entirely for all original and unbiassed inquiry, and which ends only in rivetting the chains of ignorance and error.

Similar in its effect to the admiration of great names, is the *tendency to be dazzled* with whatever rises, in the least degree, above the ordinary level in the productions of the human mind. Too much satisfaction and complacency in what has already been attained may have the effect of obstructing further progress. This, Lord Bacon observes, has particularly shown itself in the inventions of the mechanic arts. We are, perhaps, more ready to rest in an empty admiration of what has been effected, and to amuse ourselves with the apparent opulence of human power, than to reflect on the little progress that has been made in bringing matter under our control, and to consider the vast field that still lies open before us. After all, in mechanical instruments the ultimate principle is very *simple*—all may be reduced to a few laws of nature. In a clock, for instance, which seems, in one view, to imitate the movements of the heavenly bodies, and in another, to resemble the pulsations of animals, by its regular and successive motions, a few principles only are ultimately employed, as the law of pendulums, depending chiefly on gravitation. With what sentiments, however, would the ancients have looked on such an invention as the steam-engine, in which, nevertheless, the whole of the novelty, strictly speaking, lies in the application of the expansive power of steam! The causes of retardation in the improvement of knowledge, dwelt on in this part of Lord Bacon's work, have certainly been counteracted, in our time, by that rapid succession of inventions which has marked the increase of the sciences, though, in other respects, there would be much more to foster the complacent admiration he speaks of.

Another considerable cause of error and ignorance to the world, is placed, by this most accurate observer, in the *pedantry* of philosophers themselves, who have contrived to impose on mankind by their pompous airs, and affected manner of teaching—by the trickery of a meretricious and bombastic oratory, and by the subtil divisions and definitions they have employed; so as to inspire the vulgar with a profound idea of their wisdom, and to leave the impression that the sciences were exhausted by their learned labours, and nothing remained now to be investigated. No doubt this has, in every age, been a fertile source of obstruction to human improvement. The most dignified, and even sacred

professions have been too often degraded by a conceit and a quackery which, while it has disgusted the discerning, as the subterfuge of incompetent effrontery, and has proved an injurious bar to the exertions of modest and genuine merit, and to the progress of pure truth, has not failed to gain its own selfish ends, in the plaudits of an ignorant multitude. The only cure for this evil is the general diffusion of knowledge among all classes of society, which is, most happily, a leading feature of the present illustrious times.

The ancient and erroneous systems of philosophy obtained an additional hold on the public mind, also, in consequence of the *vanity* and the extravagant *pretensions* of not a few individuals of more modern date. Lord Bacon had to encounter this disadvantage in the very enunciation of many of the topics of inquiry to which he desired to recal the attention of the world in a just and scientific method: we allude to his notices for increasing men's acquaintance with the mineral kingdom; for obtaining more information with regard to the winds and the weather; the means of prolonging human life, and other inquiries. He complains of the weakness and imposture of many who had amused the credulity of mankind with great promises, in reference to such topics as the retardation of old age—the relief of pain—cures for the deceptions of the senses—the method of exciting the affections by sympathy, or a species of animal magnetism—the exaltation of the intellectual faculties—the transmutation of substances, as professed by the alchemists—the procuring of celestial influences—divination of future events—the revealing of secrets—and other such like conjuring. Thus, as real history may sometimes have suffered in its credit from fiction, and there are some who would consign the conquests of Julius Cæsar to the same scale of probability with the fabled exploits of Arthur of Britain, or Amadis de Gaul, so the spirit for great designs has been quenched by the dread of what might prove chimerical and romantic, and men have been contented to repose in the solemn and received dogmas of antiquity.

"So great, moreover," adds Lord Bacon, "has been the pusillanimity and indolence of men, that they have been wont to satisfy themselves with *very slender performances;*" often exalting, with the title of new mechanical inventions, what were, in fact, nothing more than some trifling modifications of old ones—this has been another barrier, he considers, to the advancement of the sciences.

But one of the most formidable obstacles to the genuine knowledge of nature is to be found in the *superstition* which has mingled itself with the great and momentous subject of religion. We learn from Aristophanes, in his play of "*The Clouds*," that among the Greeks, those who first attempted to assign the natural causes of thunder and storms were condemned as the enemies of the gods. Nor did some of the early Christian Fathers, as our author remarks, meet with much less severe anathemas for daring to assert, on the evidence of infallible proof, the spherical figure of the earth, and the existence of *antipodes*, or people at the other side of the globe, whose feet are opposite to ours. It is known to most of our readers that Galileo, the inventor of the telescope, was consigned to the dungeons of the inquisition at Rome, for the crime of asserting the motion of the earth round its own axis, and was con-

demned to do penance, by repeating once a week the seven penitential psalms for the space of three years!—The blending of the scholastic and Aristotelian philosophy with religion, in the middle ages, was a fruitful source of this kind.

Lord Bacon's remarks on this subject are so just, and so important, that we shall quote him at length. "As things now are," he says, "it is still more difficult and dangerous to discourse on nature, on account of the summaries and methods of the scholastic divines, who have, with all their might, reduced theology to order, and fashioned it into an art; and have, moreover, blended too much of the disputatious and thorny philosophy of Aristotle into the body of religion. And to this subject, though in a different respect, belong the labours of those who have ventured to deduce and confirm the truth of Christianity from the principles and authority of philosophers; celebrating with great pomp and solemnity the intermarriage of faith and sense, as a lawful union, and soothing the minds of men with a grateful variety of matter, while at the same time they have rashly and incongruously mingled things divine with human. In such medleys, moreover, of divinity and philosophy, only those things are admitted which are *now* received in philosophy, whilst things that are new, though better than the old, are almost entirely excluded. In fine, we perceive, that through the ignorance of certain divines, the passage to any philosophy, though ever so true, is almost blocked up. For some are foolishly alarmed lest a deeper inquiry into nature should transgress the bounds of sobriety; and they injudiciously wrest what is said in Scripture against those who pry into divine secrets, and apply it to the hidden things of nature, which are nowhere forbidden. Others, with greater craft, imagine, that if men are kept in ignorance, all things may be the more easily managed by dexterity of hand, and the *divining rod*, which they think is highly serviceable to religion: this, however, is nothing else than to aim at pleasing God by a lie! Others, again, dread the effect of example, lest any changes and movements in philosophy should fall at last on religion itself. Others are afraid lest, in the inquiry into nature, something should be found which may overturn religion, or at least undermine it, especially among the ignorant. These two latter kinds of fear appear to me altogether to savour of a grovelling wisdom; as though men, in their secret thoughts, were doubtful and distrustful of the stability of religion, and of the power of faith over the senses, and on this account apprehend danger to it from the search after truth in natural things. But whoever considers aright will acknowledge, that, next to the word of God, the most certain cure of superstition, and the best aliment of faith, is the knowledge of nature. Therefore philosophy is given to religion as her most faithful handmaid; the one manifesting the will, the other the power, of God: nor did he mistake who said, 'Ye err, not knowing the Scriptures, and the power of God,' thus inseparably blending and joining together the knowledge of his will, and the contemplation of his power. In the mean time, it is less to be wondered at that the increase of natural knowledge has been restrained, when religion, through the ignorance and incautious zeal of some, has been set in opposition to it."

The *customs of learned societies* had also, up to the time of Lord Bacon, proved a serious hindrance to the advancement of knowledge.

In the schools and universities of Europe, scarcely any room was given for improvement, which was branded with the invidious name of innovation, an alarm that could not but prove fatal to the interests of pure truth. If any one dared to exercise the right of judging for himself, he could hope for no encouragement from others; and if he possessed sufficient independence of mind to stand alone, he must pay for his temerity with the loss of his fortune and his good name. All was rigidly confined within certain rules, and a given track was marked out as that in which every one must go without deviating either to the right or left. Little scope was afforded to the power of genius, which could hardly expand upwards beneath the overwhelming load of scholastic prejudice that weighed it down. Perhaps even in our own enlightened age, few of the universities of Europe are entirely emancipated from these shackles, as may be seen from the tendency there has always been to adhere to an *Aristotelian division* of the sciences, instead of following nature. "Unwilling as I am," says Mr. Stewart, at the close of his second volume on *The Philosophy of the Human Mind*, "to touch on a topic so hopeless as that of academical reform, I cannot dismiss this subject without remarking as a *fact*, which at some future period will figure in literary history, that two hundred years after the date of Bacon's philosophical works, the antiquated volume of study, originally prescribed in times of scholastic barbarism, should in so many universities be still suffered to stand in the way of improvements, recommended at once by the present state of the sciences, and by the order which nature follows in developing the intellectual faculties."

Lord Bacon also complains that in his time arduous endeavours at improvement were *not rewarded*. The power of advancing knowledge must proceed from the energies and exertions of superior minds, but the rewards which sweeten labour were in the hands of the vulgar and untutored. Even the boon of praise was, he observes, withheld, since the flights of elevated minds are above the reach of the crowd, and are disregarded through the force of prevailing prejudices.

Finally, science was kept in bondage by a kind of sullen *despair of success*, and the supposition of impossibility attaching to any new endeavours.—Such are the causes assigned in the *Novum Organum* as the principal sources of continued error and uncertainty in the pursuits of knowledge and science.

### VI. *Grounds of hope regarding the Advancement of Science.*

In that division of the work which we may call the *sixth* section, our author proceeds to treat of the *grounds of hope* for the further advancement of the sciences, and the general improvement of knowledge. Thus the *improvement in navigation* was to be regarded as the harbinger of good to the sciences, as enlarging the field of observation, and tending to increase our knowledge of nature.

The very *errors of past times* likewise, properly viewed, furnished a hope of amendment. Demosthenes endeavoured to rouse the Athenians from despondency to arm themselves manfully against Philip, their great enemy, by telling them that even their past misfortunes should be re-

garded as an omen of their future success, since they arose from their own negligence; whereas, if they had strenuously exerted themselves, and had still been unsuccessful, they might justly have despaired of the future: so, in the sciences, it would have been presumptuous to expect any great improvement, if we could have supposed mankind to have travelled so long in the proper road to truth without reaching it; but as they had evidently mistaken the way, hope of future success must be sought in first returning to the right path. The true method of science is ingeniously compared to the economy of the bee, which first gathers matter from the fields and gardens, and then digests and prepares it for use by her own native powers: "so," Lord Bacon observes, "the matter of philosophy must be carefully collected from nature, and then, after being digested and elaborated in the understanding, must be treasured up in the memory," in other words, additional hope of advancement in the sciences is to be found in the union of things that had been disjoined; that is, a strict *combination of experience with calculation and reasoning*. In all the schools of Greece, natural philosophy was blended with some foreign admixture, and was never studied purely and by itself. The Aristotelians corrupted it with a perversion of logic; the school of Plato mixed it up with an imaginative theology; the second school of Plato, Proclus, and others, made it to arise out of mathematics; whereas it is justly remarked that mathematics ought "not to generate or create natural philosophy, but only to terminate and perfect it;" that is, the facts and laws of nature must be sought independently, or in Nature herself—then mathematical reasoning may be applied to estimate and measure them, as has been exemplified in several of the tracts already before our readers. A return to the study of natural philosophy in a *pure and separate form*, was another source, therefore, of hope.

So also it might be expected that in future *some philosopher* might arise of sufficient independence of mind and lofty genius to free himself and the world from all the old and hackneyed theories: such a person, it is lamented, had not then appeared. How prophetic this was of the immortal Newton, who burst upon the world almost immediately after the death of Bacon, his forerunner—and how completely he emerged from the rude and undigested chaos of ancient fables into the light of truth, as those very comets whose laws he laid down issue from the dark abysses of space to their perihelion, the reader is sufficiently aware.

Much, very much, is also augured, as likely to arise from a better *history of nature* than had as yet been collected. The accounts which had been extant of the appearances and facts in nature had been chiefly founded on popular reports, indolent observations, and often on mere idle tales; and the whole had been so framed and turned as to strengthen the existing opinions in philosophy. Almost every thing in the history of nature was undefined and vague; much good must, therefore, needs have been expected to accrue from a more accurate register of facts and experiments. Bacon exhibits a rough sketch of such a history of nature in his *Sylva Sylvarum*, in his *Tables*, and in other parts of his works; the merits and defects of which we shall have occasion to notice hereafter.

Similar advantage was to be anticipated from a more enlarged stock

of *mechanical experience*, and a more enlightened attention to the most instructive facts of this kind. The workman is apt to think only of what is useful to his immediate work, and is not concerned about the discovery of truth: but, in order to improvement, recourse must be had to experiments, which, though useless, perhaps, as to direct and immediate profit, may be of great importance as to general information.

To this larger and more accurate stock of experience, Lord Bacon again insists, must be added the *method of induction;* or, as before explained, the pursuit of knowledge by reasoning from particulars to generals, from which every thing is to be hoped. In order to render this method as efficient as possible, it is strongly recommended accurately to commit to writing all the materials of philosophy, that is, the facts and observations on which general principles are to be founded; by no means trusting them, as had too often been done, to the memory, whose defects were usually supplied by a fanciful invention. To give this method still greater perfection, it is remarked that *tables* should be used for the clear arrangement of the facts, according to the nature of the subject; and from these tables *axioms*, or general principles, should be carefully formed, gradually rising from the less to the more general. It must be acknowledged, indeed, that many discoveries had been made accidentally by the alchemists, while seeking to make silver and gold; yet it is evident that more is to be expected in inventions from industry and method, whether we consider the number of such discoveries, the saving of time, or the adaptation of the things discovered to the supply of our wants. Men are more likely to find what they are carefully and intelligently in search of, than what is left merely to the operation of blind chance.

It was to be regarded as an additional ground of hope that *some things* already discovered were such as had previously never entered the mind of man; or which would, in all probability, have been despised as impossibilities, if any one had declared them likely to be found out. Gunpowder, though a destructive invention truly, may be taken as an instance. If, before this discovery had been made public, it had been declared that there was a method of battering down walls, and making an impression on the strongest fortifications at great distances, those who heard of it would instantly have supposed that this was effected by increasing the power of the common engines of war that were previously in use, as battering rams, and other machines of the same kind; which, of course, must be done by means of additional weights, wheels, and levers, and the various combinations of the mechanical powers; "but no one," says Bacon, "would have thought of a fiery wind which should blow with such a prodigious expansive violence, no obvious examples of such effects having been previously seen, except in the sublimer operations of nature, storms, thunder, and earthquakes, which it would not be supposed were imitable by art." Perhaps, to the ancients the expansive force of steam, now so extensively employed, would scarcely have appeared less wonderful, which, while it possesses such amazing power as to produce the most terrible effects when allowed to explode by being confined, is yet capable of being regulated at pleasure, and directed to an immense number of useful works with the greatest advantage. The invention of silk is mentioned as

another example. So, likewise, if, previously to the invention of the compass, it had been said that a certain instrument should be made known which in the open sea, and in the dead of night, when neither stars nor moon appeared, would exactly point out the quarters of the heavens, and that this instrument was nothing more than a metallic substance, which might easily be overlooked among the similar productions of the earth, this would have seemed almost incredible. Whence it is argued that many other things may yet remain in nature that might be of great service to mankind, which have little relation or analogy to the things already discovered.

Again, on the other hand, there are inventions of such a kind as easily to be *overlooked* for want of method, though they may almost, so to speak, stare men in the face. While some things, as gunpowder, silk, the compass, sugar, paper, may seem to depend on certain properties to be developed by Nature herself, yet other things, the art of printing, for instance, contains nothing that is not obvious and completely within human power; nevertheless, the world was for many ages destitute of this admirable invention, which is so intimately connected with the propagation of knowledge. Hence a ground of hope that science might be improved was to be drawn, not merely from the consideration of the unknown operations of nature hereafter to be discovered, but from the probable result of transferring, compounding, and variously applying those laws and operations which were already known.

Lord Bacon also derived encouragement from reflecting on the immense expenditure of time, genius, and property that had been bestowed on *pursuits of little or no use*, alluding, probably, to alchemy, the professed magic arts, astrology, etc.; since, if but a small portion of this labour should come to be bestowed in a proper manner, and on proper objects, great things might be expected to result: especially would such extensive and laborious *histories* of the *facts* and *operations* of nature as he recommended be the source of expectation. "A great and royal work truly this," he says, "and of much labour and expense."

As a further ground to suppose that human knowledge might be improved and increased to an extent of which some were inclined to despair, Lord Bacon introduces *his own example*, "not," he modestly says, "by way of ostentation, but because it may be useful." He argues, that if he himself—a man as much employed in civil affairs as any other of the age in which he lived, for he was Lord Chancellor of England at the time his *Novum Organum* was published;—if he, a man of but infirm health, has had the honour to lead the way unassisted by any coadjutor, in the new and untrodden path which he here attempts to point out to posterity; what may not be expected from men of leisure; from a union of labours; from a proper division of them, and from opportunities afforded by the succession of ages? He concludes his remarks on the grounds on which is founded the hope of advancing the sciences, by intimating that even were this expectation much less than he rightly deemed it to be, or, to use his own language, "although a much weaker and fainter breeze of hope should breathe from *this new continent*," or world of science, which he is endeavouring to point out;

yet it would be worth men's while, at all events, to make efforts to explore nature by the light of this new method: there was, at least, *a chance* of success resulting from their labour; whereas, to sit down in despondency, and to decline all enlightened exertions, could lead to nothing but ignorance and error, and was unworthy of the dignity of the human mind.

### VII. *Further Remarks preparatory to the Inductive Method.*

The last or seventh section into which this former part of the Novum Organum may be divided, is designed to give *some further idea of the new method here proposed of interpreting nature.* This, however, is done rather by way of guarding the reader against erroneous expectations than by developing the method itself which he reserves for the second part. "Having now levelled and polished the mirror," says our author in his figurative and expressive diction, "it remains that we set it in a right position, or, as it were, with a benevolent aspect towards the things we shall further propose. For to a new undertaking, not only a prepossession in favour of a rooted opinion is prejudicial, but a false notion and imagination of what is proposed to be done is equally so. We must, therefore, endeavour to convey a just and true idea of what we intend."

In order to prevent misapprehension, he again cautions his readers, as he had done at the outset of his work, against supposing that he aspired to be the founder of a *new sect* in philosophy, after the manner of the ancient Greeks. It was his aim, and it was an aim worthy of such a master-spirit, not to reign over men's opinions, but to conduct them into the temple of truth, from whose inmost sanctuaries they might obtain such a panoply as would enable them to extend the boundaries of man's power over nature, not in the noisy triumphs of a scholastic warfare; but in glorious victories over ignorance, prejudice, and error. Though he thus disclaims the idea of attempting to found a new sect, it must be allowed that he possesses that honour in the highest sense; for if we were, in the most general manner, to designate the philosophers of modern times, in contradistinction to the Aristotelians and Platonists of an earlier period, we should call them *Baconians:* Bacon may himself very justly be accounted the Father of the modern philosophy. He, however, contents himself here with aspiring, as he says, "only to sow the seeds of pure truth for posterity, and not to be wanting in his assistance to the first beginning of great undertakings."

Lord Bacon wishes his readers, in perusing his work, not to be prejudiced against the method he recommends, nor disappointed on finding that he has not made any very striking *discoveries*, which, indeed, he does not profess to have done; his design, in fact, being obviously of a more general nature. For though in the *Novum Organum*, and in his other works, indications and outlines of discovery are to be found, yet he considered that, up to his time, there was no sufficient collection of facts and appearances, to enable any one to enter with advantage on the genuine interpretation of nature. Still he did not wish to discourage any from employing their sagacity in attempting to make discoveries on the foundation of what was already known, or

from making use of his own tables and outlines of a history of nature, to this end; but his own great object, he repeats, was to prepare the way for future improvements, and not to neglect this his main design, for the sake of hasty and unseasonable diversions, like "Atalanta" in the fable, who lost the race by stopping to pick up the golden apple. "For we do not childishly affect golden fruit, but place every thing in the victory of art over nature."

He next cautions the reader against the effect which may be produced on his mind from meeting with some experiments in the *history* of nature, and *tables* of invention, which seem *not* well *verified*, or which may even be absolutely *false*. Such errors are to be expected to creep in at the dawn of the day of Science, and Lord Bacon was certainly by no means free from them. It must not, on account of a few such oversights, be suspected that the inventions he would point out are grounded on doubtful principles and erroneous foundations; and he argues that if any should be disgusted with some particular mistakes in his account of facts in nature, what must be thought of the remiss and negligent method that had hitherto been employed, and what of the philosophy and of the sciences that were built upon such "quicksands?"

Nor are men to turn away from the inductive method, or from the experiments it demands, as if in some cases it dwelt too much on what might seem *minute*, or *trite* and *vulgar*; since great mischief has arisen from many things having been spoken of as known and ascertained, of which, in fact, little was understood. Thus, in the philosophy that was prevalent, *gravity*, the *celestial motions*, *heat*, *cold*, *hardness*, *fluidity*, *density*, *animation*, *similarity*, *organisation*, were all the subjects of dogmatic assertion, while little that was satisfactory was said respecting them. Men, however, must condescend to attend to the commonest things if they would acquire knowledge, and to things displeasing to the senses. The design here is "not," he says, "to build a capital or erect a pyramid to the glory of man, but to found the temple of the universe in the human intellect." None are to suppose, what the vulgar are too ready to imagine, as well as all who were devoted to the existing philosophy, that the minutiæ here laid down are tedious and subtil; they ought rather to consider that, for a time, efforts should be made to increase the materials of knowledge, to kindle the light by which nature may be examined, and that a too great impatience for immediate advantage should be checked. If any one should be inclined to disregard the cautions, principles, and axioms laid down in the method of induction, as needless subtilties, what would he say to the schoolmen, who are full of subtilties, 'without end as without fruit?'

As an apology for what to many would appear a *bold* and *daring* attempt—that of rejecting all the sciences, and all the ancient masters in philosophy as with one stroke, without admitting the authority of any one single renowned name of antiquity, and trusting only to his own unaided strength—the author remarks that, were he disposed to act insincerely, it would not be difficult to persuade men that what he here attempts is but a revival of the most ancient method of Science, before nature was pompously ushered in with the "flutes and trumpets of the Greeks;" and, well acquainted as Lord Bacon was with the mythology of the ancients, it would have been easier perhaps for him

to have gained over the admirers of antiquity by this expedient, than to render palatable a system which presented no gaudy and alluring theories, and which came out entirely as a modern innovation. But with that astonishing degree of freedom from the shackles of prejudice, considering the time in which he lived, and that devotedness to natural truth for its own sake, which was so characteristic of this great philosopher, he disdains all such "stratagem and imposture," and relies exclusively on the evidence of things themselves. It is his object to place before the mind, not the mock models of the world which others had framed, of which the theories of Aristotle, Plato, and Epicurus, are specimens, but to present the world's true model as it exists in nature—to trace before the eyes of men the exact lines of truth.

Another objection, which it is supposed may be alleged, is, that, notwithstanding all the labour here employed to impress on mankind this new method of studying the Sciences, it will probably do no more than land us at length in *some one of those systems* of philosophy which prevailed among the ancients—that they, in the beginning of their investigations, procured a large stock of observations and experiments, and digested them into books and tables, as is here recommended, and from these sources extracted the matter of their theories; but thinking it needless to publish their notes and minute observations, those materials of their labours are now lost to us,—as architects, after a building is finished, take down the scaffolding and framework, and remove them out of sight. To this it is answered, that though it is difficult to suppose the ancients completed their works without some such collection of materials, yet, at all events, it is certain, from their writings, that their method of philosophizing was no other than flying hastily from some particular examples, to general conclusions; and if any new examples occurred, bearing an aspect hostile to their favourite ideas, they either contrived to make them seem to square with these, or else struck them out as exceptions, thus sacrificing every thing to their beloved theories. Now the very method here insisted on, Bacon argues, of rigidly adhering only to those principles which are common to all the particulars and examples, precludes the possibility of arriving at the same results with the ancients.

Nor can it be fairly charged upon this method of carefully attending to all the facts of the case before drawing the conclusion, that it leads to *scepticism*, since it is not the disposition to doubt, but the art of *doubting properly*, that is alone inculcated; and it is preferable to know something in a certain manner without supposing we know all, than to think we know all, and yet remain in actual ignorance of that which is most necessary to be known.

Lest it should be supposed, moreover, that the proposed plan only extended to the improvement of *natural* philosophy, more properly so called, he distinctly informs his readers that his design is of the most general kind possible. The method of induction is equally useful in all the sciences. It is alike applicable to *ethics*, *politics*, the *philosophy* of the *human mind*, *chemistry*, *botany*, and every other branch of knowledge.

As a further stimulus to a vigorous pursuit of science in this enlightened method, this first part of the *Novum Organum* closes with a

few additional reflections. It is urged that the discovery of *truth*, and noble inventions, holds the most *excellent* place among the actions of mankind. Antiquity, with all its errors, was perfectly alive to this sentiment, as is sufficiently evident by its attributing *divine* honours to the inventors of the arts, as to Prometheus, who is represented as being the giver of fire to mortals, and is celebrated in Æschylus as a deity—while it was usual to award *heroic* honours chiefly, to mere legislators and the founders of empires. The inventions of science, it is observed, "benefit mankind to the end of time ; while the advantages conferred by warriors and statesmen may last, in many cases, but for a few ages, and sometimes have their origin in tumults, and the most terrible desolations of war." The effects of the invention of printing and of the mariner's compass, for example, have been altogether prodigious : by these great instruments, navigation and commerce have been extended over the whole earth ; "divine and human learning," to use the words of Milton, "have been raked out of the embers of forgotten tongues," and the face of the world has been changed, in all its features, physical and moral.

The design of promoting the advancement of the sciences is further pronounced a far *nobler* object of *ambition* than either *private* aggrandizement, or even *patriotism* itself. "The first," says Lord Bacon, "is vulgar and degenerate ; the second, that is, the ambition of those who endeavour to raise their own country in the scale of nations, is more noble, but has not less of cupidity : but if any one should labour to restore and enlarge the power and dominion of the whole race of man over the universe of things—this kind of ambition, if so we may call it, is without doubt more wise and dignified than the rest. Now this power of man over things is entirely founded in arts and sciences."

"Finally," adds this illustrious author, "should any one object that the arts and sciences may be abused to *evil* purposes, as luxury and wickedness, let this sentiment be allowed to have no weight. The same objection would equally apply to all the most excellent things in the world—as genius, courage, strength, beauty, riches, and even light itself. Let the human race regain their dominion over nature, which belongs to them by the bounty of their Maker, and right reason and sound religion will direct the use."

Thus did this vast genius point out to mankind the causes of those errors which so long effectually obstructed the paths of science ; thus did he encourage them to hope for a brighter æra, and give directions for the more successful pursuit, in future, of knowledge and truth. The second part of the *Novum Organum* contains a further developement of the principles of the *Inductive Method*, with the author's own examples of its use : and it will form the subject of another Treatise.

# ACCOUNT OF THE NOVUM ORGANON.

## *THE SECOND, AND CONCLUDING PART.*

HOMO, NATURÆ MINISTER ET INTERPRES, TANTUM FACIT ET INTELLIGIT QUANTUM DE NATURÆ ORDINE RE VEL MENTE OBSERVAVERIT: NEC AMPLIUS SCIT, AUT POTEST.——*Nov. Org.*

WE now proceed to give to our readers a view of the remaining part of the *Novum Organum*, as contained in the Second Book. Lord Bacon's design here is—to unfold his plan more particularly; and to convey some idea of the actual operation of that method of studying nature which he had the discernment to perceive was so absolutely essential to the advancement of all real science; and which he had the independence of mind to lay before the world, at a time when philosophers were generally devoted to hypotheses and fancies, and seemed but ill-disposed to an humble and laborious search after truth for its own sake, or to give encouragement to any one who should aspire to this arduous and honourable course.

We shall, as before, give the analysis of Bacon's doctrines, with such remarks and additional illustrations as may tend to throw light upon them. We are aware, indeed, that this part of his philosophical works has been regarded, and not unjustly, as somewhat laboured and obscure; but surely we must not forget the disadvantages under which he wrote; nor the wonderful revolution in science which he was the first instrument in effecting. It is certain, indeed, that, at the time when he flourished, the spirit of rational inquiry was not utterly unknown. In some few minds there was already a rising tendency to throw off the yoke of ancient systems, and some few instances were not wanting of the successful use of experiment; but no one had hitherto had the boldness and the genius, at once to make a formal attack on the general order of things as they existed in science, and to frame the grand and universal outline of another and a better plan. It was reserved for Bacon to proclaim aloud to the ear of Science, that she could only hope to be regenerated by first sacrificing herself on the altar of Truth; and that if ever she took an upward flight, she must pass a fiery ordeal, and rise like a phœnix from her own ashes.

Bacon, in this respect, stood alone; and if his *New Machine of the Sciences* appear, on more minute examination, to be somewhat cumbrous and defective, it was still a mighty effort to have devised such an instrument at all. If the genius of the new philosophy first issued from the thick darkness of the middle ages, wearing the garb and speaking the cramp language of the schools, this was perhaps an unavoidable consequence attaching to the period of its birth. The enlightened style of philosophy which now prevails, is certainly nothing more than the spirit of what Bacon taught, freed from all needless technicalities and incumbrances; and exercising, to the best advantage, its own proper energies. If Bacon did not perfectly exemplify his own rules of philosophizing, and if we sometimes see, as is certainly the case, the remains of ancient error in his con-

clusions, we should remember that he kindled the broader light we now act in, and which makes us discern clearly the imperfections of his own method. It is he who has enabled us to consider as ordinary and manifest truths, propositions utterly denied to his predecessors; and to complain of things as obscure, which to him were new, and were seen across the settled and distorting mist of error, and to us are clear only through the purer medium of his philosophy.

The second book of the *Novum Organon* may be divided into three parts; which comprise Aphorisms, or remarks on what is termed *the Discovery of Forms; Tables* in illustration of this discovery; and the *Doctrine of Instances*.

### Section I. *Of the Discovery of Forms, or Causes, in Nature.*

After the primary object of ascertaining *facts*, or collecting the history of nature with regard to any subject of inquiry has been effected, the next aim proposed is, by comparing these different facts, to produce certain *changes* in matter; and to discover the ultimate *causes* on which its qualities depend. "The object and aim of human power," says Bacon, "is to produce a *new nature*, or natures on a given body; and the object and aim of human knowledge is to discover the *form* of a given nature; that is, its real difference; the nature which makes it what it is (*naturam naturantem*), or, the source whence it flows."

The scholastic word *form* here employed is borrowed from the Platonists, though with a meaning different from theirs. Plato and his followers adopted the notions before held by the Pythagoreans with respect to *forms, ideas,* and *essences;* and regarded the various configurations, or shapes of matter, as nothing more than copies of their *essences*, or *ideas*, as existing in the divine mind. Thus, for example, since the squares or circles actually drawn by the mathematician are never absolutely accurate, they supposed that their true *archetypes* or *patterns* are to be found subsisting by themselves in the mind of the Deity. Now Plato, and his school, maintained that this perfect *intellectual world* was discoverable by contemplation; and that while the visible creation is the object of *sense*, these ideas, or essences—the *forms* of things abstracted from matter,—are the proper objects of *science*. Bacon, in his work on the *Advancement of Learning*, while he pays the tribute of praise due to Plato's genius, condemns, as well he might, his mystical philosophy; and intimates that the *forms* which he himself proposes to discover are to be found *in* matter, and not *out* of it. In another passage in the *Novum Organon*, he expressly defines what he means by *forms*, in the following manner:—"When we speak of *forms*, we understand nothing more than those *laws* and *modes* of action which regulate and constitute any simple nature; such as heat; light; weight; in all kinds of matter susceptible of them: so that the *form* of heat, or the *form* of light, and the *law* of heat, or the *law* of light, are the same thing; nor do we ever lose sight of practice, and things as they are."

"The form of any nature" is, in another place, defined to be "such, that where *it* is, the given *nature* must infallibly be. The form is perpetually present when that nature is present; ascertains it universally, and accompanies it every where. Again, this form is such, that when

removed, the given nature infallibly vanishes: therefore the form is perpetually wanting where that nature is wanting; and thus confirms its presence or absence, and comes and goes with that nature alone."

In the language of Bacon, then, the *form* of any substance is its *essential nature*—the *form* of any quality is that which constitutes that quality. Thus, if the subject of investigation were the quality of *transparency* in any substance, the *form* of it is something of such a nature that, wherever it is present, there is transparency; and wherever there is transparency, that which is here scholastically termed the form, is likewise present. The *form*, he says, is the same thing, as regards our knowledge, with the *cause;* not limiting the meaning of this word to the *antecedents* or *circumstances* which immediately produce a succession of *events* or *changes* in matter, but including also the source from whence *permanent qualities* in body are derived. In short, the *discovery of forms* may be regarded as signifying the discovery of the *laws of nature* in general.

It may serve to facilitate our apprehension of Bacon's ideas, if we carry along with us the remark, which has not improperly been made, even by his greatest admirers—that he appears, from the language he sometimes employs with regard to forms, to have placed the ultimate aim of philosophy beyond what it is, in all probability, given to man to reach, however rigidly he may employ his faculties, according to the method here recommended. He seems to think that a knowledge of the *ultimate essences* of the qualities, and powers, or properties of matter, lie open to human scrutiny; that we can discover, for instance, wherein consists the *essence* or *nature* of *transparency;* of *cold;* of *heat;* of *colour*. Upwards of two centuries, however, have rolled away under the auspices of Bacon's system; and no one would as yet affirm that we have actually arrived at the boundary of nature, so as to have discovered the essence of matter itself, or of any one of its various modifications. We are still ignorant, strictly speaking, of the *causes* of the various operations of nature, after ages of laborious and scientific investigation; nor will the philosopher profess to have ascertained, with regard to any one series of these causes, or successive events and changes, that he has, beyond all possibility of doubt, at length arrived at the beginning of the series; that he has laid his finger on the ultimate link in the whole chain which is held by the hand of Omnipotence; and that he has traced the identical point at which these second causes merge, and are lost in the secret agency of the great First Cause of all; if indeed it be not more proper to consider all second causes as nothing more than so many constant actions of the Deity, regulated by his own laws.—In the case of *heat*, for instance,—by conducting inquiries in the spirit of the inductive method, many of the effects and properties of this powerful agent have been discovered; but its *form*, to use Bacon's language, or, in other words, *what heat is*, has not been ascertained. Perhaps a complete knowledge of its essence might, even if it could be known, conduce less to practical uses, than we may be ready to imagine: certain it is, however, that the question still remains undetermined, whether heat be a subtile fluid, and therefore of a *material* nature; or, as Bacon himself supposed, nothing more than a certain *motion* among the particles of bodies.

The same remark is applicable to the other great agents in nature,

as *gravity, electricity, light, magnetism, elasticity*. Perhaps our notion of gravity is as simple as any, since its *one* property is the law of its decrease with the square of the distance; but whether this, and the rest have, or have not, any second causes beyond themselves, none presumes to say. While it would be unphilosophical to assert that more *can never* be known of these agents than what is already ascertained, it may be observed that, even should Bacon's aims, as to the discovery of forms, always prove to have been too high for mortals to fulfil, this is no disparagement whatever to his method, which still remains applicable to the investigation of causes, to the uttermost limits that can be reached by the perseverance and ingenuity of man.

"To the discovery of forms," proceeds Bacon, "belongs that of the *latent process* (*latens processus*); continued from the manifest producing cause of changes in bodies, and what is obvious to the senses, up to the giving of the form itself," that is, the ultimate law of nature in the particular case; or, at least, what appears to be that law: "there also," he adds, "belongs to it the discovery of the *secret structure*, (*latens schematismus*,) of bodies that are *quiescent* and exhibit no motion. The *latent process* we speak of does not here mean certain visible measures, or signs, or steps of procedure in bodies, but a perfect continued process, the greatest part of which escapes the sense. Thus, for example, in every generation and transformation of bodies, it comes to be inquired, what is lost, or flies off; what stays behind; what is added; what dilated; what contracted; what united; what separated; what continued; what cut off; what impels; what obstructs; what prevails; what yields, etc.: nor are these things only to be sought in the generation, or transformation of bodies; but, after the same manner, it comes to be inquired in all other alterations and motions, what precedes; what succeeds; what is quick; what slow; what gives motion; what governs it; and the like. But all these things remain unknown and untouched in the sciences, which are at present formed in a very gross and perfectly inadequate manner."

This *latent process*, undoubtedly a grand object of philosophical inquiry, to the farthest verge of human power, is, therefore, in modern language, the invisible and secret progress by which sensible changes are produced; and involves what has been termed the *law of continuity;* that is, the law by which quantities which change their bulk, or their places, do so, not abruptly, as in many cases may seem to us, but by passing through all the intermediate magnitudes, or distances, till the change be completed. In other words, all changes, however small, must be effected *in time*. We see this in innumerable operations of nature, such as the *planetary movements;* the phenomena of *accelerated velocity* in falling bodies; the *motion of light*, shown by the eclipses of Jupiter's satellites; in the progress of *disease*, in which there is a change of the structure of the parts. The late Professor Playfair remarks on this subject, "to know the relation between the time and the change effected, would be to have a perfect knowledge of the latent process;" the meaning, of course, is, if we could know all the *minutest* changes: for we may know, by experience, how much *time* it may take to effect a *given* change on matter, without knowing what *intermediate* changes may have led to the given one. In explanation of Bacon's doctrine, Mr. Playfair adds, "in the

firing of a cannon, for example, the succession of events during the short interval between the application of the match, and the explosion of the ball, constitute a latent process of a very remarkable and complicated nature, which, however, we can now trace with some degree of accuracy. In mechanical operations we can often follow this process more completely. When motion is communicated from any body to another, it is distributed through all the parts of that other, by a law quite beyond the reach of sense to perceive directly, but yet subject to investigation, and determined by a principle which, though late in being discovered, is now perfectly recognised. The applications of this mechanical principle are perhaps the instances in which a latent, and indeed a very recondite process has been most completely analysed." The allusion here is to the laws which regulate *percussion*, *collision*, and the *communication* of *motion* in bodies.

What Bacon terms the *latent schematism*, or structure of bodies, is that unseen shape and arrangement of their parts on which, it is obvious, so many of their properties must depend. The internal structure of plants, and the constitution of crystals, are instances; an inquiry into these is an inquiry into what is here quaintly termed the *latent schematism;* as also such an inquiry into *electricity*, *gravitation*, *magnetism*, etc., as would be directed towards the attempt to explain these facts, by any peculiar structure of bodies, or any arrangement of the particles of matter. "The inquiry," says Bacon, "and discovery of the concealed structure in bodies, is as much a new thing as the discovery of the latent process, and form; for men have hitherto trodden only in the outer courts of nature; and are not prepared to enter within. But no one can superinduce a new nature on a given body; or successfully and appositely change it into another body; unless he has first a competent knowledge of the body to be altered or transformed."

It must be confessed that Lord Bacon, emerging as he did from the prejudices of those ages in which philosophers pretended to account for almost everything, seems not only to have anticipated, as we have already observed, a greater perfection in human knowledge than it will probably ever attain, but also to have somewhat mistaken the way in which knowledge is to be converted to practical purposes. He supposes that if the *form*, or cause, or law, of any quality were known, we should be able, by inducing that "form" on any body, to communicate to it the said quality. It is not obvious, however, that even this knowledge would necessarily conduce to more simple and advantageous methods, than those of which the arts now furnish so many specimens. We are quite ignorant, for instance, on what *colour* in bodies precisely depends—what peculiar construction of surface it is, which makes a body reflect one particular species of light rather than another; yet we know how to communicate this quality from one substance to another. Would a knowledge of that concealed structure, on which this reflection depends, enable us to impart it to bodies more easily than we are able to do by immersing them in a liquid of a given colour?

Lord Bacon proceeds to make some remarks upon several of those *changes* in bodies, which he seems to have considered it within human power possibly to produce. He partly draws his illustrations from the pursuits of the alchemists; and makes some suppositions savouring to

us a little of paradox, though we cannot but discern his great sagacity, and admire his persevering diligence, amidst all the disadvantages under which he laboured. "We shall examine," says he, "what kind of rule, direction, or leading, a man would principally wish for, in order to superinduce an assigned nature upon a given body; as if any one should desire to superinduce upon silver the yellow colour of gold; and to increase its specific gravity; or to superinduce malleability upon glass; or vegetation upon a body not of the vegetable kind."

"The rule for the transmutation of bodies is of two kinds. The *first* regards a body as a certain collection, or combination of *simple natures* (*properties*). Thus, for example, in gold, there meet together yellowness; a determinate gravity; malleability to a certain degree; fixedness in the fire; a particular manner of flowing in the fire; a determinate way of solution, etc., which are the simple natures (properties) in gold. For he who understands forms (causes), and the manner of superinducing this yellowness, gravity, ductility, fixedness, faculty of fusion, solution, etc., with their particular degrees, and proportions, will consider how to join them together in some body, so that a transmutation into gold shall follow."

"But the *second* kind of rule, which depends upon discovering the *latent process*, proceeds by *concrete bodies*, such as they are found in the ordinary course of nature: for example,—when inquiry is made from what origin, by what means, and in what procedure, gold, or any other metal, or stone, is generated from its first fluid matter, or rudiments, up to a perfect mineral. Or, again, by what process plants are generated, from the first concretions of their juices in the earth, or from the seed to a formed plant; together with the whole succession of motion, and the various aud continued endeavours of nature. And this inquiry does not only regard the generation of bodies, but likewise other motions and works of nature: for example,—when inquiry is made into the whole series and continued actions of nutrition, from the first receiving of the aliment to a perfect assimilation; or, after the same manner, into the voluntary motions of animals, from the first impression of the imagination, and the continued efforts of the spirit, down to the bending and moving of the limbs; or again, in explaining the motion of the tongue, lips, and other organs, up to the formation of articulate sounds. For these things, also, have regard to concrete natures, or natures associate and organical.—And where mankind has no power of operating, but only of contemplating, yet the inquiry of the fact, or truth of the thing, belongs, no less than the knowledge of causes and relations, to the primary and universal axioms of simple natures: suppose, for example, the inquiry about the nature of spontaneous rotation, attraction, and many other natures; which are more common and familiar to us than the celestial bodies themselves. And let no one expect to determine the question whether the diurnal motion belongs to the heavens, or to the earth, unless he first understand the nature of spontaneous rotation."

The above passages, while they furnish an example of that acuteness and comprehension which so eminently distinguished their author, are not free from indications of his propensity to expect too much from human ingenuity, and to place the evidence of truth, in some respects, too high. His remark, for instance, with regard to the

"nature of *spontaneous rotation*," whatever idea he attached to it, as belonging to the celestial motions, may account, in some measure, for his prejudice against the doctrine of *Copernicus*, which attributed the diurnal motion to the earth, and not to the heavens; and which had been published to the world many years before Bacon flourished. Indeed, a proneness to form boundless expectations as to what human power might effect; and, in the very infancy of practical science, to look for achievements higher than we can, even in its more advanced age, venture to hope for, is one of the most remarkable features in the elevated and daring genius of this great man.

Further, to explain his views with regard to the inquiry into the *latent structure* of bodies, he points out what he conceives to be some of the proper objects on which this minute investigation may be instituted, as iron and stone; the root, leaves, and flowers of plants; the flesh, blood, and bones of animals. *Distillation*, and other methods of separation, are instances, as collecting together the different homogeneous or similar particles of the same body. He here, however, acutely cautions the chemists of his day against supposing that all the natures (qualities) which may be exhibited in the separation of the parts of any substance, must have existed in the compound; new natures (properties) being often superinduced by heat, or some other method of resolving bodies; "for this structure," he observes, "is a thing of great delicacy and subtilty, and may be rather confounded, than discovered and brought to light, by the operations of fire." He adds, in his usual serious and imaginative style: "Bodies, therefore, are to be separated, not (merely) by fire, but by reason, and genuine induction; with the assistance of experiments; for we must go over from Vulcan to Minerva, if we would bring to light the real textures and structures of bodies."

On the sanguine expectations and lofty aims which Lord Bacon indulged, with regard to what human industry and perseverance might effect, he proposes to found what he terms the "just division of philosophy, and the sciences," into *metaphysics* and *physics*. "The inquiry of *forms*," he says, "which, from the reason of the thing itself, and their own law, are eternal and immutable, may make *metaphysics;* and the inquiry into the efficient cause, the matter, the *latent process*, and the *latent structure*, may constitute *physics*, since these several (latter) particulars regard the ordinary course, and not the fundamental and eternal laws of nature." Certain it is, that however just such a general division of all human knowledge might be in Bacon's sense of it, could we realise his ideas and aims as to the *discovery of forms*, no progress has, as yet, been made towards the hopeful attainment of such a system of metaphysics; and probably the more secret operations of nature may for ever remain so shrouded from human penetration, as to render it impossible to say, in any one instance, that we have reached the goal, ascertained the very *first* in the series of second causes, and drawn the exact line between the subordinate operations of matter, and the immediate agency of the Infinite Spirit.—The following passages, on the "*raising of axioms, or principles from experience*," are introductory to the tables in which Bacon has exemplified his own method of induction, in an inquiry into the "form" of *heat;* or, in what heat consists.

"The raising of axioms from experience is divided into three kinds of administrations or helps; 1. for the sense; 2. for the memory; and 3. for the reason."

(1.) "Therefore, a just and adequate natural and experimental history is to be procured, as the foundation of the whole thing; for we are not to fancy or imagine, but to discover what are the works and laws of nature."

(2.) "Such history must be digested and ranged in proper order; therefore tables and subservient chains of instances are to be formed in such manner, that the understanding may commodiously work upon them."

(3.) "And though this were done, yet the understanding, left to itself, and its own spontaneous motion, is unequal to the work, and unfit to take upon it the raising of axioms, unless it be first regulated, strengthened, and guarded; therefore, in the third place, genuine and real induction must be used as the key of interpretation."

"The inquiry of *forms* proceeds in this manner. First, all the known instances, agreeing in the same nature, though in the most dissimilar subjects, are to be brought together, and placed before the understanding. And this collection is to be made historically, without any overhasty indulgence of speculation, or any great subtilty for the present. We will illustrate the thing by an example in the inquiry into the *form* of heat."

Section II. *Of the Tables given in Illustration of the Inductive Method.*

The materials from which Lord Bacon designed that *tables* of this kind should be composed, for the future advancement of science, were such as he himself has sketched out in his book entitled, after the quaint fashion of the time, *Sylva Sylvarum*, or "A Natural History; in Ten Centuries;" each of the ten sections into which it is divided containing one hundred facts and experiments, relating to a great variety of subjects; the term *natural history* being here used in a very extensive sense, to signify a record of observations on nature in general.

Such a history of facts as that from which tables should be drawn, was to contain an account of the subject under examination, in all the varieties and modifications of which the appearances belonging to it were susceptible. Not only were these facts in nature to be included in it, which offer themselves at once, and of their own accord, to the senses, but also all those experiments which might be instituted for the discovery of new facts relating to the same inquiry. These facts and experiments were to be ascertained with the greatest care; faithfully and simply stated, without mixing up any theory with the narration of them; and distinctly arranged. If any thing rested on doubtful evidence, this was not to be altogether excluded from the history of the subject, but to be noted down as uncertain, together with the reasons for so regarding it; and it was not to be employed as evidence in the discovery of *forms,* or ultimate causes, till rendered more probable by other facts, on which there rested nothing doubtful. In short, this *history* of nature was to be, as much as possible, a copy of nature herself, both as regarded obvious facts, and actual experiments; for, in experiments, as Bacon observes, "man does nothing more than bring things nearer to one another, or carry them farther off; the rest is performed

by nature." This remark has its exemplification in such operations as the firing of a pistol, the discharge of an electrical jar, and in all the experiments of chemistry, in which the art of man does no more than commence the process by applying the spark to the gunpowder, or by causing the connection between the inside and outside of the jar to be produced, or the electric circle to be completed; or by bringing the chemical agents into contact with each other; the rest is done by nature herself.

It must be acknowledged that a single glance into the *Sylva Sylvarum* will convince the reader that it is far from answering to the standard which its great author sets up for regulating the collection of the materials of scientific inquiry. In his "Experiment Solitary touching the commixture of flame and air, and the great force thereof," he says, "As for living creatures, it is certain their *vital spirits* are a substance compounded of an airy and flamy matter. It is no marvel that a small quantity of spirits in the cells of the brain, and canals of the sinews, should be able to move the whole body, which is of so great mass; such is the force of these two natures, air and flame, when they incorporate." It is unnecessary to adduce other specimens, many of which are to be found, as fanciful in matter, as vague in statement, and as gratuitous in evidence; in a word, exhibiting as complete a departure from the severity of the inductive method. Yet, amidst this indigested mass of facts and fancies, it is impossible not to discern the unwearied diligence, the acuteness, the boundless curiosity, and insatiable appetite for knowledge, which Bacon possessed. It is interesting to see the energies of such a mind grappling with the difficulties which inevitably surrounded it; eager for liberty, beneath the shackles that cramped its exertions; panting for the pure air of truth, amidst those oppressive mists of error which beset it on all sides; and more readily taking up with error, from its very impatience for truth. Bacon's faults as a practical natural philosopher, the occasional credulity and love of theory which he manifests, are only the more remarkable from his having so admirably descanted on those very errors by way of speculation. To free himself from the actual dominion of error in natural science, even though he had such lofty general conceptions of truth, was perhaps impossible in his situation. The morning star of nature is, in the language of Milton, "last in the train of night," though it belongs "better to the dawn;" and the sun himself cannot shake off the mists that attend his rising—time is needed to dispel them: Bacon was the first grand luminary of science, and it was no wonder that a portion of the darkness of the middle ages should still cling around him.

Nor was he himself unaware of the imperfection of those crude and recent materials from which, for want of collections of facts sufficiently accurate and long-established, he was obliged to deduce his tables. Perhaps, what he chiefly intended was a rough sketch of the history of nature, leaving it to posterity to follow out his plan with greater accuracy, and with all the advantages of time. This appears, indeed, from the caution which he gives his readers, quoted in our former Treatise on this work, not to reject his method itself, because some experiments and facts may not be so well verified as might be wished; or others even absolutely false. The same may be gathered from the

following remarkable passage in the Preface to the *Sylva Sylvarum*, by Dr. Rawley, who was Lord Bacon's chaplain. "I have heard his Lordship often say, that if he should have served the glory of his own name, he had been better not to have published this Natural History; but that he resolved to prefer the good of man, and that which might best secure it, before any thing that might have relation to himself. And, in this behalf, I have heard his Lordship speak complainingly, that his Lordship, who thinketh he deserveth to be an architect in this building, should be forced to be a workman and a labourer, and to dig the clay and burn the brick; and to gather the straw and stubble over all the fields to burn the bricks withal. For he knoweth that except he do it, nothing will be done; men are so set to despise the means of their own good."

Lord Bacon formally *exemplifies* his method of induction in this part of the *Novum Organon*, on the subject of *heat*—his object being to inquire, what is its *form* or *nature?* In order to institute this inquiry, he arranges the facts and experiments he was acquainted with relating to it, in *five different tables*. These tables, while they partake of all the imperfections found in the *Sylva Sylvarum*, can scarcely be denied the praise, as Professor Playfair remarks, of being "extremely judicious," while the whole disquisition, as the same excellent judge observes, "is highly interesting."

*Tab.* I.—The *first* table contains instances in which heat is found and is termed, by the author, the "*Affirmative Table;*" or "*Instances that agree in possessing the nature of heat;*" and here are enumerated the sun's rays, direct and reflected; fiery meteors; lightning; flame; ignited matter; hot springs, and heated fluids in general; sultry seasons; subterraneous air; the coverings of animals; all bodies exposed to the action of fire; sparks struck out by collision; matter in a state of friction, as the wheels of carriages; green and moist plants when pressed together, as hay; slaked lime; iron in a state of effervescence with acids; the bodies of animals; herbs that are hot to the taste, as cresses: vinegar also is added, as applied to the flesh; and even intense cold producing a burning sensation.

*Tab.* II.—The *second table* which Bacon proposes in pursuit of his method, is *negative;* containing a list of *things in which heat is not found:* but, for the sake of brevity, the examples here introduced are to be only of those things which have a *near relation and resemblance* to the things mentioned in the first table, *heat* alone *excepted,* in which they are, to all sense, wanting. Thus, the first example of the "*instances agreeing in possessing heat,*" were the *sun's rays;* and the parallel *negative* instance, or the first mentioned in the *second* table, are the *rays of the moon*, of *stars*, and of *comets*, since these are all luminous, though less so than the rays of the sun, but are *without heat.* In like manner, every instance in which heat *exists* in the things enumerated in the *first* table, is to have one or more parallel instances in the *second*, in which heat is *wanting;* though the substances in both the tables seem nearly related to each other.

*Tab.* III.—The *third table* consists of a *comparison of the degrees of heat* found in different substances. The things first to be considered are such as discover no heat whatever to the touch, but seem only to have, says Bacon, "a certain *potential heat, or a disposition and prepara-*

*tion* towards actual heat." Quicklime, green plants, acrid vegetables, etc., are mentioned as examples. The first degree of heat sensible to the touch, he considers to be that of *animals;* and inquiry is to be made respecting the comparative heat of the different kinds of animals, and of different parts of the same animals; and the causes by which animal heat is increased. The degrees of heat in various kinds of *flame* are also to be observed; as in the flame of alcohol; of porous vegetables; of wood; of unctuous substances, as oil and tallow; of pitch and resin; of sulphur; of gunpowder; of imperfect metals, as regulus of antimony; and of lightning. Also the degrees of heat in *ignited* bodies, as in tinder, coal, and metals. The thermometer (*vitrum calendare*), which was just come into use when Bacon wrote, is mentioned as showing the extreme aptitude of the common air to receive and communicate heat; being affected by the slightest change of temperature. Next to the air, those bodies were imagined to be most sensible of heat which had been newly changed and condensed by cold, as snow and ice; then is mentioned conjecturally quicksilver; next unctuous bodies, as oil and butter; afterwards wood; water; and lastly, stones and metals, as not heating so easily, though they retain their heat a long time.

This table, while it discovers, like the rest, the exhaustive genius peculiar to its author, and the enlarged general views which he took of the subject of inquiry, possesses the same defects as it regards accuracy in the facts; and occasionally the same insensible tendency to theorize. It appears singular enough, for instance, to us, who know the property which oxygen has of sustaining combustion, that the increase of heat should be accounted for mechanically thus: "Motion increases heat, as appears by bellows and blow-pipes;" and that after a description of the thermometer, and the sensibility of the air in respect of heat and cold, it should be added, "but we conceive that the spirit of animals has a still more exquisite sense of heat and cold, unless it be obstructed and blunted by the grosser matter of their bodies." Yet it is here remarked—"How unprovided we are in natural and experimental history, may be easily observed from hence; that in the preceding tables we are frequently obliged to direct experiments and further inquiry into particulars; and that, instead of approved history, and such instances as may be depended upon, we are sometimes driven to insert *traditions*, and *stories*, though we do this with a manifest doubting of their truth and authority."

These *three tables*, containing a great number of such *positive*, *negative*, and *comparative* examples on the subject of heat as we have quoted, are designed, Lord Bacon says, to "present a view of instances to the understanding." And when this view is procured, the business of *induction* is to be put in practice. "For, upon a particular and general view of all the instances, some quality or property is to be discovered, on which the *nature* of the thing in question depends, and which may continually be present or absent, and always increase and decrease with that nature; and limit the more common nature. God, the giver and Creator of *forms*, doubtless knows them by immediate affirmation, and at the first glance; and so, perhaps, may angelic intelligences; but this is certainly beyond the power of man, to whom it is given to proceed, first, by *negatives* only, and after a perfect exclu-

sion by *affirmatives.* We must therefore make resolution and separation of nature, not by fire, but by the mind, which is, as it were, the divine fire. And thus the *first* work of genuine induction in the *discovery of forms*, is to throw out, or exclude, such particular *natures* as are not found in any instance where the given nature is present; or such as are found in any instance where that nature is absent; and again, such as are found to increase in any instance when the given nature decreases; or to decrease when that nature increases. And then, after this rejection and exclusion is duly made, the affirmative, solid, true, and well-defined form will remain as the result of the operation, whilst the volatile opinions go off, as it were, in fume. And if any one shall think that our forms have somewhat abstracted in them, because they appear to mix, and join together things that are heterogeneous, as the heat of the celestial bodies, and the heat of fire; the fixed redness of a rose, and the apparent redness of the rainbow, or the opal; death by drowning, and death by burning, stabbing, the apoplexy, consumption, etc., which, though very dissimilar, we make to agree in the nature of heat, redness, death, etc., he must remember that his own understanding is held and detained by custom, things in the gross, and opinions. For it is certain that the things above-mentioned, however heterogeneous and foreign they may seem, agree in the *form* or *law* that ordains heat, redness, and death."

The first step, therefore, according to Bacon, in an inquiry into the *form* or *cause* of any thing by induction, is to consider what things are to be excluded from the number of *possible* forms or causes. This exclusion contracts the field of inquiry, and brings the true explanation of the case more within reach. Thus, suppose the subject in question be, to use the language of our author, the form of *transparency;* or in other words, the quality which is the *cause* of transparency in bodies: now since the *diamond* is transparent, we immediately exclude *fluidity*, and *porosity*, or *rarity;* because the diamond is a very solid and dense substance: that is, a body may be transparent, without being either fluid or light, compared with other bodies; neither fluidity nor lightness, then, are the form or cause of transparency.

*Tab.* IV.—Bacon's *fourth table*, accordingly, proposes to exhibit "an example of this exclusion, or rejection of natures from the form of heat; that is, a rejection of those things as the *causes* of heat, in which it evidently cannot consist. Thus, as both the sun's rays and common fire are hot, he excludes both "terrestrial and celestial nature." *Light* and *splendour* are also rejected as essential to heat, because water, air, and solid bodies will receive or conduct heat without being ignited; and, on the contrary, the rays of the moon and stars present light without any sensible heat; also because ignited iron is less lucid, but hotter than the flame of alcohol. Again, *tenuity*, or a certain lightness of substance, is to be excluded as the cause of heat, because gold, which is very dense, can be ignited; while the air, which is generally cool, is thin and subtile. *Expansive motion* is also to be rejected, Bacon says, "because ignited iron enlarges not in bulk, but remains of the same dimension;" this, however, is contrary to a well-known fact in the economy of heat.—As bodies are warmed without *destruction of the parts*, this destruction is to be excluded. Other things also are to be rejected, "for our tables," says the author, "are not designed as perfect, but only as examples."

Hence, it is added, at the end of this table, "The business of exclusion lays the foundation for a genuine induction, which, however, is not perfected till it terminates in the affirmative; but an exclusion is by no means perfect at first, nor can it possibly be so; for exclusion, as we plainly see, is the rejection of *simple natures;* and if we have hitherto no just and true notion of simple nature, how can the business of exclusion be rectified? But some of the above-mentioned notions, as those of *elementary* (or terrestrial) nature, *celestial* nature, and *tenuity*, are vague and ill-defined. Wherefore we must proceed to greater helps for the mind. And yet we judge it useful to allow the understanding to apply itself and attempt the business of interpreting nature in the affirmative, on the strength of the instances contained in these tables, and such as may be otherwise procured. And this kind of attempt we call a *permission of the understanding*, the rudiments of interpretation, or the first vintage of inquiry."

*Tab.* V.—The next, which is the *fifth table* and the last, is accordingly quaintly entitled, "*The first Vintage concerning the Form of Heat;*" that is, a rough and general specimen of a conclusion derived from the foregoing investigation. Bacon concludes, here, that from an examination of all the instances, "separately and collectively, *the nature whose limitation is heat, appears to be motion,*" which he attempts to prove from the view he took of the facts. He adds, "what we have thus said of motion is to be understood of it as of a *genus*, with regard to heat, and not as if heat generated motion, or motion generated heat, though this may be true in some cases; but the meaning is, that *heat itself*, or the very existence of heat, *is motion*, and nothing else, though motion limited by differences, which we shall presently subjoin."

He next points out these "*differences*," as he terms them; that is, he endeavours to discover what *kind* of motion this is of which he speaks. He *first* argues that it is *expansive*, whereby a body dilates itself; which, however, is hardly consistent with his observation on ignited iron in the fourth table. The *second* "difference," or quality of the motion is, that heat is an expansive motion toward the circumference, and which at the same time rises upwards. "The *third* difference," he says, "is that this motion is expansive in the lesser particles of a body;" and "the *fourth* difference is, that the motion in which heat consists is rapid." All this he attempts to prove, and concludes thus: "Let this serve for what we call the first vintage, or an attempt towards interpreting the form of heat, which the understanding makes, as we said, by way of permission. The fruit of this first vintage is in short: Heat is an expansive, bridled motion, struggling in the small particles of bodies. But this expansion is modified; so that, while it spreads in circumference, it has a greater tendency upwards. It is also vigorous and active. And as to practice, if, in any natural body, a motion can be excited which shall dilate or expand, and again recoil or turn back upon itself, so as that the dilatation shall not proceed equally, but partly prevail, and partly be checked, any man may doubtless produce heat And this may serve as anexample of our method of investigating Forms."

Notwithstanding the imperfection of these tables as to their detail, the want of accuracy in the experiments, the crudeness, and the apparently gratuitous style of Bacon's conclusions, amidst the laboured appear-

ance of the whole, it is worthy of remark that his hypothesis on the nature of heat is the very same as one of those which still, at the distance of nearly two centuries, divide the opinions of philosophers. The more direct and elegant manner in which the moderns have employed his inductive method, has not, in the very instance which he first chose as an example of it, enabled them to go one single step beyond him. It is still a question, whether heat be really *matter*—a subtile fluid capable of diffusing itself in bodies; or any thing more than a *motion*, vibration, or rotation, excited among their particles. All the experiments that have been made up to the present time, have not availed to set the question at rest; and the greater part of the facts relating to heat may be explained equally well on either of the two suppositions.

### Section III.—*Of the Doctrine of Instances, or Facts, as regards the Discovery of Forms.*

It is obvious that *all* facts, however well authenticated they may be, are not of equal importance in the discoveries of science. Some facts are so like others, that it may be quite unnecessary to notice them. Some exhibit the subject of inquiry in its most simple state; others present it with a combination of circumstances. In some cases the thing sought appears in its highest degree; in others in its lowest. In medicine, for instance, a disease sometimes presents itself in its purest form, and most regular progress; at other times it is involved in a variety of other symptoms that do not belong it. Hence Lord Bacon proposes to consider what he calls *Prerogativæ Instantiarum, Prerogative Instances;* or the *comparative value of facts* as means of discovery, or instruments of finding truth.

The design here is to show what are the *most important* and essential *particulars* in every inquiry; or what instances in the operations of nature are chiefly to be sought for, and attended to, in order to discover the laws of nature in general, to whatever extent man may be able to ascertain them. The conclusion on the subject of heat being only to be regarded as an *example*, and not as a perfectly established truth, Bacon retraces, in a manner, his own steps, and proceeds to treat, generally, and more accurately, of the way of procuring a proper collection of such facts, experiments, and observations, as are best fitted to constitute *affirmative*, *negative*, and *comparative* tables, like those we have described; and this in order, ultimately, to shorten the inquiry, and to render it more rigid.

We shall now give our readers an outline of these "*Prerogative Instances;*" or those cases which have a chief claim to be noticed in the attempt to interpret the laws of nature; retaining the terms which Bacon figuratively applies to them. He divides them into three classes, which he denominates those which address themselves to the *understanding;* those which assist the *senses;* and those which conduce to *practice.*

#### I. *Instances addressing themselves to the Understanding.*

1. The first are the *Instantiæ Solitariæ; solitary* instances. These are divided into *two* classes.—The *first* are those examples in which the the *same* "nature," or quality, exists in different bodies, which have

*nothing* in common but that quality; that is, the bodies differ in all things but in this one. The conclusions that can be entertained in this case, respecting the *form* or cause of this quality, are limited, inasmuch as they involve none of the things in which the bodies differ, but only that in which they all agree. Crystals, prisms of glass, and dew-drops, are *instantiæ solitariæ*, because they exhibit colour, in some situations, while they have nothing in common with stones, metals, wood, flowers, etc., whose colours are fixed, excepting the colour itself. Hence Bacon infers that colour is, in the first substances, that is, in crystals, etc., simply a modification of the rays of light, produced by the different degrees of *incidence*, or the angles which light makes in falling on them; and in the latter case, as in stones and metals, he concludes that colour depends on the texture and structure of the surface. It was by these examples that Newton afterwards discovered the composition of light.

The *second* class of *solitary instances* are the reverse of the former. They are those cases in which the " nature" or quality, which is the subject of inquiry, *differs* in two bodies which are in all other respects the same; that is, the bodies here agree in all things but this one. The *form* or cause here, therefore, cannot exist in any of the general things in which the bodies agree. The veins of black, and of white, in marble, and the variety of colours in flowers, are adduced as examples; where the substances agree, almost in everything but in colour. Bacon here again concludes that permanent colours depend chiefly on the texture of the surfaces of bodies, and very little on their internal and essential properties.

2. *Instantiæ Migrantes*, or *travelling* instances, are those in which one quantity is lost, and another is produced; or, in which the nature or quality inquired into exhibits changes and degrees, passing from less to greater, or from greater to less; in the one case approaching its *maximum*, or greatest state, in the other tending to extinction altogether. Let the inquiry be into the cause of *whiteness*, in bodies that are of this colour. *Glass* and *water* are mentioned as examples. Glass, when whole, is without colour; but, when powdered, becomes *white:* so water in its natural state is colourless, but is white when in the state of *foam*. Both these substances pass from a state of transparency to an opaque state. " It is manifest," says Bacon, " that the form (cause) of whiteness travels or is conveyed over by pounding the glass, and agitating the water; nothing, however, is here found but a bare comminution of the parts, together with the interposition of the air; and whiteness is exhibited by a different refraction of the rays of light." Metals becoming *fluid* by heat, and again *solid* by its abstraction, might be added as another example. Also the *shells* which are often found perfect in limestone, and by degrees become lost in the finer marbles, till they are no longer discerned. The mineral kingdom presents *this* kind of instances in the greatest abundance, and such facts are, perhaps, nowhere of greater importance in practice. The barometer also furnishes an instance of this *progressive* kind; for on going to the top of a mountain the mercury sinks, which it ought to do, if it be the weight of the atmosphere that supports it, because the column of the atmosphere is now shorter.

3. Next come the *Instantiæ Ostensivæ, glaring* instances; which our

author also terms *eluscentiæ*, and *predominantes*, or instances which shew the *nature* or quality in its highest power and degree, and freed from the obstructions which usually counteract it. The nature which is the subject of inquiry is here, as is represented, fully displayed, either by the absence of such obstructions to it, or by its prevailing over them by its own energy. The *thermometer* is judiciously chosen as an example; this instrument very obviously shewing the expansive force of heat in its operation on air. Perhaps, Lord Bacon is not so happy in adducing *quicksilver*, on account of its fluidity, as a *glaring* instance leading towards the discovery of what *gravity* is; for gold, which is heavier than quicksilver, becomes fluid also by the application of heat; and quicksilver is solid at a certain temperature.

Professor Playfair adduces as an example of this class, the shells, corals, and other marine exuviæ, or their impressions, found imbedded in solid rocks, and on high mountains, as decisively proving the original formation of such land under the sea.

4. The *Instantiæ Clandestinæ*, or *obscure* instances, may be considered as opposed to the last. Bacon has also fancifully called them *Instantiæ Crepusculi*, *twilight* instances. These are the cases in which some quality or power is just beginning to manifest itself, and is in its weakest and most imperfect state. These he regards as peculiarly important in attempts at generalisation. He mentions an example with reference to the nature of *solidity*, exhibited in a low degree in a fluid, when water, blown into a bubble, assumes a kind of consistent skin, and may be thrown in this form to a considerable distance; and he infers, from such cases, that fluidity and solidity are only relative ideas, and that bodies have what he terms "a real appetite to avoid discontinuation." Water suspended in *capillary*, or very small tubes, is another illustration. This effect may be viewed when at its *minimum*, or in the least degree, that is, when the tube is increased in its bore. The column of water now becomes a slender ring, going all round the vessel. As this ring must be formed by the attraction of the sides, and of the part directly above the water, there can be no doubt that the capillary suspension arises, in part at least, from the same cause.

5. In the fifth place, are noticed the *Instantiæ Manipulares*, or *collective* instances; that is, general facts, comprehending a number of particular cases; tending to carry us to a certain extent in the discovery of *causes*, and assisting in the attempt towards a further generalisation.

The *laws of Kepler*, not mentioned by Bacon, though discovered before he wrote, are a case in point. These laws, which aided Newton in detecting the principle of *gravitation*, are three general truths or facts in astronomy; each of which holds with regard to every planet. These laws are, that the planets all move in oval orbits round the sun, placed in the common focus; that a line, supposed to be drawn from this focus, or point in the ellipse, to any planet, passes over equal spaces in equal times; and that the squares of the times of revolution round the sun are always as the cubes of the mean distances from him. Each of these laws was discovered, after vast labour and research, and by comparing together an immense number of observations. In such collective instances astronomy is fertile. A planet is seen in the heavens; by long and diligent attention, it is

found to move in a certain direction, with a certain velocity, and to perform its revolution in a certain time. Hence the periodic time, or the year of every planet is a collective fact,—a fact resulting from numerous observations.

Bacon's example of this kind of instances is taken from *memory*, the nature of which is supposed to be the subject of inquiry. Collective instances, tending to conduct us some way in the investigation, are, he says, such facts as these; namely, that *order*, *artificial associations* of ideas, and *verse*, aid the memory; also whatever appeals to the *senses*, or the *passions*, so as strongly to excite them; again whatever is presented to a mind that is *free* and unoccupied, as is the case with children; what is noticed for the *first* time; and what we make an *effort* to retain—these things are usually best remembered. This instance may serve to show the comprehensiveness of Bacon's design, which was to prescribe rules for all kinds of investigations, whether relating more strictly to natural philosophy, or, as here, to intellectual science; indeed, it was in his ideas relative to the conduct of the understanding in its pursuit of truth that he chiefly excelled.

6. *Instantiæ Conformes*, or instances that are *parallel*, or analogous, are facts which resemble each other in some particulars, while in all the rest they are very different. Optical instruments and the eye; the structure of the ear, and of caverns that yield an echo, are mentioned as examples. Also the fins of fish; the feet of quadrupeds; and the wings of birds.

It was the obvious analogy between the eye and the telescope, that led to the formation of *achromatic*, or colourless glasses: the means of which invention were pointed out by observing the different refractive powers of the *humours* or lenses of the eye, which prevent the field of view from being coloured round its edges; this was successfully imitated in the telescope. On the other hand, *art* has, by a similar instance of conformity, been able to point out what takes place in nature: the experiment of the *camera obscura* led to the discovery of the image on the *retina* of the eye, by suggesting the probability of it.—Sir James Hall's experiments may be added; showing that the presence of calcareous spar, in *trap* rocks, and its absence in *lava*, may arise from the degree of compression under which the fusion of the former took place. Basalt and other trap rocks have a structure so exactly similar to the lava of volcanoes, that it could scarcely be doubted that their origin was equally derived from the agency of fire; hence the successful inquiry into the cause of the difference.—The valves in the blood-vessels of the human body resembled those used in hydraulic machines for preventing the return of the water; hence Harvey took the hint which led him to the discovery of the circulation of the blood.

7. Next are mentioned what are termed *Instantiæ Monodicæ*, *singular*, or irregular facts; such as are "out of course;" or are remarkably distinguished from all other instances of the class to which they belong. Examples are, the sun and moon among heavenly bodies; the magnet among stones; mercury among metals; the elephant among quadrupeds. To these of Lord Bacon may be added such instances as the newly-discovered planets, which do not move in the zodiac, and are of a much smaller size than the others; also Saturn's

ring, which is the only case we know of the kind.—Those stones called *aërolites* also, which have sometimes fallen from the heavens, may be noted as presenting a singular class of well-authenticated facts, not yet satisfactorily explained.

8. Almost the same with the last, but mentioned as distinct by Bacon, are the *Instantiæ Deviantes*, or *deviating* instances; "that is," he remarks, "errors of nature; things monstrous and uncommon, where nature turns aside from her ordinary course. These errors of nature differ from the *singular* instances, which are miracles in species; while these errors are miracles in individuals. And here the *latent process* that leads to the deviation is to be inquired into."

Examples of these are, he adds, "all prodigious and monstrous births, and productions of nature; and of all things new, extraordinary, or uncommon in the universe. And here such things are to be suspected as the prodigies of Livy; and those no less which are found in the writers on natural magic, alchemy, etc., who are the professed admirers and lovers of the fabulous."

9. *Instantiæ Limitaneæ*, or *limiting* instances, are also very near akin to the *singular*. They are those which exhibit, as it were, a combination of *two* different kinds in the same individual: the bat and the flying fish are examples; also the mole; and all combinations of different species; among these none are more remarkable than the strange quadrupeds lately discovered in New Holland, partaking of the structure both of birds and beasts, and called, by naturalists, the *Ornithorhynchus Histrix* and *Paradoxus*.

10. The next place is assigned to what are called the *Instantiæ Potestatis*, instances of *power;* by which are meant the most remarkable productions of human ingenuity; or, as they are described, "the most noble and perfect works, and such as may be called the masterpieces in every art." Here are introduced the destructive inventions of gunpowder and ordnance; the manufacture of silk; also that of paper, on which he comments with great admiration, as very singular in its texture among the productions of art. He notices also glass, porcelain, and enamel; and adds that contrivances of "dexterity, delusion, and diversion," are not wholly to be rejected from the enumeration, nor even "things magical and superstitious; charms; the supposed sympathy of spirits," etc.; because, under the falsehood of these things, the true operations of nature may oftentimes be concealed.

Of these instances, it would be endless to adduce the examples which might be furnished by the modern improvements in art and science; the *steam-engine* alone might suffice, as connected with a world of inventions, each of which would have appeared to our indefatigable author a "masterpiece of art;" witness only one of the applications of it, namely, to the working of vessels on water. But in the line with gunpowder, or rather in advantageous contrast to it, may well be placed the safety-lamp,—aptly termed by Professor Playfair, "the most valuable present that science ever made to art."

11. *Instantiæ Comitatûs, atque Hostiles*, or instances of *accompaniment* and *separation*, are those in which certain qualities, or properties, always accompany each other, and the reverse.

Of the first kind are *flame* and *heat;* that is, all flame possesses heat, while in air, stones, metals, heat is merely accidental, or may

come and go. So also, excepting a very few particular cases, *heat* and *expansion* are an instance of this class; heat being accompanied with an increase of the substance in which it resides. *Body* and *gravity* may also be adduced; for whatever is impenetrable and has *inertia*, that is, everything of which we can certainly say, it is *matter*, possesses also weight, more or less.

The *hostile* instances, or those of *separation*, are opposed to the former; that is, the quality which is the subject of inquiry is always absent from them. Thus, in the case of solidity: air, and elastic fluids in general, cannot, so far as we know, assume a solid form; they are never exhibited in this state, although the discoveries of Mr. Farraday have limited the number of permanently elastic fluids by condensing, through pressure, many which were before thought incondensable. So, in the case of *transparency:* this, in solid bodies, is not found joined with malleability.

12. *Instantiæ Subjunctivæ, subjunctive* instances, or those which may be subjoined to the last, as seeming nearest to approach the exceptions to them. "As for example," says Bacon, "the mildest and softest flames, or such as burn the least; and in the subject of *incorruptibility*, of which we have no affirmative upon this earth; yet gold comes nearest to an incorruptible body."

The other examples Bacon adduces seem rather to belong to the *Instantiæ Ostensivæ*, unless he means to point them out as showing the limits of nature in some of the *accompanying* instances: "of this kind," he says, "are gold, in weight; the whale in bulk of animal body; the hound in point of scent; the explosion of gunpowder, in sudden expansion."

13. The next instances are called *Instantiæ Fœderis*, or instances of *alliance*, or *union;* in which *natures*, properties, or qualities, supposed to be dissimilar and heterogeneous, are, on investigation, found to approach nearer to each other, if not to be the very same. These, it is observed, are of great use in leading us, from resting in differences, to *genera*, or general classes. Bacon adduces his favourite subject, *heat.* He says that, in his time, the heat of the *sun*, that of *animals*, and that of *fire*, were supposed to be perfectly different in their very *natures*. He rejects this supposition, and illustrates his meaning, with regard to these instances, thus:—"we have an instance of union in the case of *grapes* ripening sooner than the grapes of the same vine out of doors, if one of the branches be trained within side a room where a fire is kept; so that culinary fire will ripen grapes, which is supposed to be peculiar to the sun's heat." He also instances the reasoning faculty in man, and the sagacity of brutes, as in some cases so nearly approaching to the appearances of originating in one common nature, as to merit particular inquiry.

14. More important than the former, are the *Instantiæ Crucis, crucial* instances; so called, after Bacon's manner, from the crosses, or way-posts used to point out roads, because they determine at once between two or more possible conclusions.

"These instances," says the author, "are of such a kind, that, when in search of any *nature* (cause), the mind comes to an equilibrium, or is suspended between two or more causes, these facts decide the question, by rejecting all the causes but one." In these cases, each of the sup-

posed causes equally accounts for the appearances, and it is the part of the inquirer to contrive some experiment, or discover some fact, applicable to the given question, which can only be explained by *one* of these causes; by which all uncertainty vanishes, and the true cause becomes known. It is very common to speak, both in science and common arts, of *tests* and *experimenta crucis*. These are sometimes decisive both ways, and sometimes imperfect, or what may be called *unilateral*. Thus, if a flame burns in any gas submitted to experiment, we conclude generally that there is oxygen in the air; but if it does not burn, we cannot, therefore, conclude that there is none, for it may be in too close combination with some other gas to support flame. But a perfect test would be weighing any gas; for if it be heavier than common air, in the ratio of 1.435 to 1.2, it is oxygen; if lighter or heavier it is not. Thus, too, in discussing whether a given writing be innocent or libellous, that is, maliciously composed, or composed with any improper motive of any kind, the truth is a unilateral test; for if the allegations be false, there must be malice; but there may be malice also, though the matter stated be true. There would arise very great distinctness in argumentation, were we to adopt this convenient phrase of a complete and an incomplete or unilateral test—many of the errors in reasoning, especially upon moral subjects, arising from mistaking incomplete for complete tests.

In order to illustrate this division of instances, Bacon institutes an investigation into the causes of the *tides*; but the discussion is not founded on sufficient *data*; is confused by being involved with a question upon the Copernican doctrine of the rotatory motion of the earth; and the whole terminates unsatisfactorily. To determine the true theory of the tides was reserved for Newton himself; but he did it upon the genuine principles of the Baconian philosophy.

The question whether rotation belongs to the earth, or to the heavens, generally, is also introduced; and here Bacon evidently inclines to the old hypothesis, namely, that the heavens revolve round the earth which remains at rest; though he allows that, if any comet should be observed not to obey the apparent law of the celestial motions from east to west, this would be a *crucial* instance, showing that there can exist in nature a motion contrary to the visible, diurnal motion, as it appears to the sense. This question might have been determined by observing what is called, in the language of astronomy, the motion of the planets *in latitude*; that is, their deviations from the plane of the ecliptic, or the sun's apparent annual path among what are now called the fixed stars. These deviations present a set of appearances not to be reconciled with the Ptolemaic system, which makes the earth the centre of the planetary motions, but are easily explained on the theory of Copernicus, or that of the sun being at rest in the centre. This, therefore, would have been an instance of the class before us, against the Ptolemaic hypothesis, and strongly in favour of the Copernican doctrine, though some other appearances of the heavenly bodies might accord equally well with either of the two theories.—In his remarks on the subject of gravity Bacon is more happy. He proposes to solve the question whether or not bodies tend towards the earth in consequence of an attractive power belonging to it, by ascertaining whether they fall with less velocity at greater distances from it;

and this is to be done by observing whether or not the pendulum moves more slowly at great heights above the earth's surface. Both these queries have long been satisfactorily answered.

Chemistry is rich in these *Instantiæ* or *Experimenta Crucis.* The great object in experimental philosophy is, to institute some experiment which shall be similar to another in all respects but one, which, in order to be perfectly satisfactory, the method of induction generally requires. Hence, in those branches of science in which the objects of inquiry are less completely under our command, and less capable of being put to the test of varied experiments, it is difficult to distinguish the causes; and to assign to each its own proper effect. This is often the case in *intellectual* and *moral* inquiries, in *political economy*, and also in *medicine.* Chemistry, which is so completely a science of experiment, furnishes notable instances of the present class.

The celebrated *Lavoisier* performed an experiment of this kind, which exploded the doctrine of *phlogiston*, as held by former chemists. It is well known that when metals are calcined in the fire, the weight of the mass becomes greater after the process than before. The cause of this fact was a subject of inquiry. It was supposed, from some circumstances, unnecessary to be detailed, that in the calcination of a mass of tin, for instance, a certain substance is actually driven off by the fire. To this substance, the name of *phlogiston* was given; and as the metal was heavier after its escape than before, it was supposed itself to possess what they termed absolute levity.

Lavoisier instituted the following experiment: a quantity of tin was put into a glass retort, and hermetically sealed; the retort, with its contents, was then carefully weighed. The proper degree of heat was next applied, and the metal was calcined; and now the weight was found to be exactly the same as before the process: nothing therefore could have escaped through the glass. When the retort had cooled, it was opened, and the air rushed in, showing that a partial *vacuum* had been produced. The retort and its contents were now weighed a third time, and it had gained ten grains in weight: ten grains, therefore, of air had rushed into the retort on its being opened. The *calx* was then taken out, and was found to weigh exactly ten grains more than it did before calcination. The ten grains of air, therefore, which had disappeared, and had been replaced by the same weight of air, on the retort being opened, had combined with the metal during the process. This most satisfactory experiment led to the knowledge of oxygen gas, that species of air which combines with metals when they are calcined, and the doctrine of phlogiston was exploded.

15. Next in order are *Instantiæ Divortii,* instances of *separation;* "which indicate the separation of those natures which for the most part are found together. These differ from *instantiæ crucis,* as determining nothing, but only admonishing us of the separation of one nature from another." This seems a very general distinction, and not very applicable to practice. It is followed by some curious remarks by way of illustration. Bacon says that *agency* in general belongs to some substance; but doubts whether the attraction of a magnet does not furnish an example of this agency, or virtue, being neither in the magnet nor in the body attracted, but between them both. He supposes, therefore, that "natural agency, or power," may subsist for a time

without a substance; and this he would call an *instance of separation.* He makes the same remark with regard to the attraction of the earth.

It is obvious that there is here a confusion in the use of terms; and a want of simplicity in forming the notion of *cause* and *effect. Agency* is first spoken of as a quality belonging to some agent; and afterwards as a *real existence,* independent of an agent: this would be to introduce an additional agent; and to suppose, after all, that we know more of cause and effect than we actually know, which is, that one class of events uniformly goes before another class, which may be called their corresponding events; or that a certain *antecedent* always precedes a certain *consequent.* Bacon, however, singularly founds, on these supposed instances of separation, a fanciful argument for *immaterialism,* by way of corollary, which he introduces as of great importance; alleging that "if natural virtues and agencies may subsist without a body for some time in space," this may lead us to a conception of the existence of an incorporeal substance:—its existence, however, rests on better evidence, and strictly inductive, for we know the existence of matter only by its effects on our mind through our senses, and we know the existence of mind by our consciousness, or by the reflexion of the mind itself on its own operations. We have, therefore, the same kind of evidence, in a high degree, for the existence of mind as of body.

### II. *Instances tending to assist the Senses.*

The above general name is given by Lord Bacon to the five orders of instances which follow. They are called, in his usual technical style, *Instantiæ Lampadis,* instances of the *lamp,* because they propose, chiefly, to correct or inform the senses; the accurate impressions and informations of which, it is evident, are of the utmost importance in philosophical inquiries.

16. Of these five, the *first* are the *Instantiæ Januæ,* instances of the *portal,* assisting the immediate *action* of the senses, and more particularly the *sight.* Of this kind are optical instruments in general, and speaking and hearing trumpets. Bacon mentions the *telescope* as the invention of Galileo, and as bringing into view the innumerable stars of the milky way, the satellites of Jupiter, the unequal surface of the moon, and the spots in the sun; but, as he had not the opportunity of verifying these discoveries for himself, the admiration he expresses for them is tempered with some doubt as to their reality. He also notices the *microscope,* and instruments for *measuring* distances, as examples.

17. The *second* of this class are the *Instantiæ Citantes, summoning* instances; so called because they cite things, as it were, to the bar of the senses, enabling us to perceive things which were before imperceptible.

Among the causes why things escape the senses, are enumerated, *distance* of place; the *interposition* of some other body; the *unfitness* of the object to impress the senses; the shortness of the *time* during which, in some cases, the object may act on the senses; and the object, as it were, sometimes *overpowering* the senses. Whatever remedies these causes are instances in point. Bacon notices the *pulse,* as bringing to light conditions of the human frame, not cognizable by other means. He also remarks that very swift *motion* requires to be well-measured, in order to compensate for its escaping the senses;

this is now done with regard to *sounds;* and by means of the eclipses of Jupiter's moons, and the aberration of the fixed stars, the velocity of *light* itself is measured.

Other examples may be adduced from modern science: as the *barometer*, and the *air-pump*, which show the weight and elasticity of air; and the experiments in pneumatics, in general, and in electricity and galvanism, have rendered certain the existence of things, which had before entirely escaped the senses, as the *gases*, or elastic fluids. To the same head may also be reduced the late wonderful discovery of a moving magnetic fluid, or an action circular and perpendicular to the electrical current, yet connected with it.

18. *Thirdly*, follow the *Instantiæ Viæ*, instances of the *road.* "These," says Bacon, "we also term *jointed* instances, as indicating the operations of nature gradually continued; and these rather escape the observation than the senses of men." There is a propensity in men, he remarks, to be contented with viewing nature only by "fits and starts," at intervals, and when her processes are finished, while they neglect to watch her gradual method of working. This is the result of indolence. Nature's operations, however, should be carefully observed, while processes are going on, as we stand by and see the operative manufacturer carry on his work. Examples of these instances are the *vegetation* of plants; the *hatching* of eggs, throughout all their stages; such processes as *putrefaction;* and in unorganized bodies, *distillation.* These instances are somewhat similar to the *instantiæ migrantes.*

19. The *fourth* are the *Instantiæ Supplementi*, instances of *substitution*, "or those to which we have recourse," says our author, "by way of refuge, when the proper instances cannot be had." He names the *magnet*, which attracts iron through various substances which may be interposed; and adds, "perhaps some medium may be found to deaden this virtue more than any other medium; such an instance of *substitution* would be in the way of degree, or *approximation;*" that is, it would approach toward destroying the magnetic virtue. Perhaps iron has this quality in a higher degree than any other substance.

20. The *fifth*, and the last enumerated, of this class, are the *Instantiæ Persecantes*, sive *Vellicantes*, *compulsory* instances; which are thus explained. "We call them so because they *twitch* the understanding (vellicant); and because they cut through nature (persecant). They are those facts which rouse the mind to a perception of the admirable and exquisite subtilty of nature; so as that it may be awakened and stimulated to due attention, observation, and research." Bacon means, in short, those facts, which force our attention to things which are apt, from their minuteness and subtilty, to escape our observation. His remarks on these instances show how alive he was to what is curious and admirable in the laws of nature; and exhibit the genuine spirit of a philosophic observer.

Some of his examples are the following: a *drop of ink* in a pen, which is capable of so great a number of divisions into letters, in writing; the amazing length to which a *wire* may be drawn; the exquisite structure of *animalculæ;* the tincture which a little *colour* gives to a quantity of water; the small quantity of *musk* that will perfume a room, without losing any of its weight; the great

volume of smoke which is extricated from some substances, as *incense;* the *notes in music*, which are so accurately conveyed through air, wood, and other mediums, and reflected so swiftly and yet so distinctly in *echoes; light* and *colour* passing so rapidly through masses of solid or fluid matter, as through glass, or water; and at the same time conveying to the eye a great and exquisite variety of images, though the light suffers refraction and reflection; the *loadstone* attracting iron through solid bodies. To these are added the multitude of natural *operations* that are going on in the universe at the same time, without interposing with each other; as, for instance, *visible objects* are seen through the air; numerous *percussions* and articulate *sounds* are acting on it; numerous *odours*, as of flowers, are passing through it; also *cold*, *heat*, and the *magnetic* attraction: all these actions are continually going on, and innumerable more without obstructing each other.

Our laborious author subjoins, what he calls *limiting* instances to this class. Thus, though one action or operation of nature does not disturb another of a *different* kind, yet this is not exactly the case with regard to actions of the *same* kind. The sound of a flute, and the smell of a rose, may both pass through the air, and make impressions on the senses at the same time; but the report of a cannon drowns the voice: the light of the glow-worm, if emitted in the sun-beams, is not visible; and a stronger odour overpowers a weaker.

### III. *Instances leading to Practice.*

THIS division, to which Lord Bacon gives the general name of *Instantiæ Practicæ*, *practical* instances, contains those which are of principal use in practice; or in the actual effort to raise the improvement of art on the foundation of science, and thus to reduce our knowledge to some valuable purposes.

The instances of principal use in practice he regards as of *two* kinds, applicable to the two ways in which he considers that knowledge may fail of leading to actual results. This failure may be occasioned by our knowledge not being sufficiently *accurate* and precise, though sound as far as it goes; and this is often the case in natural philosophy, from objects not being exactly measured and estimated. Or the practical result that is desired may fail, through the process or experiment not being sufficiently *simplified*, but, on the contrary, encumbered and confused with operations that do not necessarily belong to it. Hence the "practical instances" are divided into two classes, of which the *first* are the *Instantiæ Mensuræ*, instances of *admeasurement;* of which he makes four kinds; and in which some estimate of the qualities and actions of bodies is to be formed, in order to remedy the first of the two above-named sources of failure; namely, the *want of precision* in our knowledge; and to aid in converting knowledge into power.

#### (1.) *Instantiæ Mensuræ, Instances of Admeasurement.*

21. The *first* of these are the *Instantiæ Radii*, or instances of the *measuring-rod;* that is, cases in which things are to be measured in respect of their relation to *space*. "For," says Bacon, "the forces and motions of things operate within certain spaces that are not indefinite and casual, but determinate and finite; and the due observance

of these spaces in every subject of inquiry is of great importance to practice."

He remarks, for example, that many qualities and properties act only by *contact.* In the *percussion* of bodies, motion is communicated by the impelling body touching the impelled; in the senses of *taste* and *touch* also the effect is produced by contact; so in *external remedies* used in surgery. Some agencies act at *small distances*, as in the case of *amber*, and the *magnet*, which attract certain substances within a certain sphere. Other agencies operate at *great* distances, as *heat*, *odours*, *sounds*, and especially *light*, the effects of all which, on the senses, are perceived when the sources of them are remote from us. The attraction of the *moon* on the sea is added, which Bacon thought a probable cause of the tides, though he does not seem to have considered his inquiry into the subject to have been sufficient to enable him to decide the question. Now all these agencies, it is argued, whether they take place at smaller or larger distances, are bounded and finite; and it is an object of science, to ascertain their *maxima*, or extreme limits; and how far their effects depend on the bulk and quantity of matter in the bodies of which they are the properties; on the peculiar nature of the properties or qualities themselves; or on the fitness or unfitness of the mediums through which the agencies take place. Cases also are noticed in which things act *only* beyond given distances, and never by contact; as in *vision*, where the *focus* must be attended to. These examples relate to *progressive* motions: the *expansion* and *contraction* of bodies were also to be regarded as kinds of motion, the laws and limits of which ought to be subjected to admeasurement.

The *Instantiæ Radii* may, it is evident, be illustrated further, by numerous instruments now used in experiments in natural philosophy; and the greater part of which were unknown to our author. The *thermometer*, indeed, was extant in his time, as a new invention, and furnished him with one source of his experiments on *heat*, as we have seen in the *instantiæ ostensivæ:* this instrument has been the principal means of furnishing us with what we know of the agency of heat, even up to the present time. The *hygrometer* is another instance: this instrument, which has been greatly improved by Professor Leslie, enables us to measure the quantity of moisture contained in the air. To these may be added all our instruments for measuring lines and angles, or *mathematical* and *astronomical* instruments generally: also those instruments which measure weight or force; as the common *scales*, the *hydrostatic* balance, and the *barometer*.

No part of Bacon's work is more calculated than this to show the comprehensive view he took of the agencies of nature, even when physical science was as yet in its first dawn. The instances in which bodies act on each other at a distance led him to form some confused idea of that universal principle, *gravitation*, which Newton afterwards so triumphantly demonstrated and applied. He suggests that there may be some kind of " magnetic virtue which operates by consent, between the globe of the earth and heavy bodies; or between the globe of the moon and the waters of the sea; or between the starry heavens and the planets, by which they may be drawn to their apogees," or greatest distances from the earth.

These *Instantiæ Radii*, which point out cases of quantities to be measured, are introduced by Bacon merely as useful in practice: they might, at the same time, have been considered as highly important, in what he terms the discovery of *forms*, or the inquiry into the natures, essences, or causes of the objects of investigation, so far forth as they may be approached. Newton found that *gravity* not only makes bodies fall to the earth, but also retains the moon in her orbit: now this could never have been shown without the previous determination of several quantities, as the law of *accelerated velocity* in falling bodies; the length of the *earth's radius* or the distance from its centre to its circumference; the *moon's distance* from the earth, and the *velocity* with which she revolves round it in her orbit. A comparison of these elements, viewed in connection with the *laws of motion*, could alone have proved that it is the same kind of force which brings a stone to the ground, and keeps the moon in her proper course. In this case, therefore, as in many others, the instances in which geometrical measures are assigned and compared, the *theory* of physics has been eminently advanced.

22. The *second* class of the instances of *measure* are termed *Instantiæ Curriculi*, instances of the *course*, in which the qualities and actions of bodies are measured by *time*. Hence Bacon also calls them *instantiæ ad aquam*, instances of the *water-glass;* alluding to the *hour-glasses* of the ancients, in which they employed water instead of sand. " For," says he, " every movement or action of nature is performed in some portion of *time;* one indeed more swiftly; another more slowly; but, all in a certain number of moments, adapted to nature. Even those actions which seem to take place in the *twinkling of an eye*, as we say, are yet different in time, as to more or less."

Familiar examples of this class are all the more obvious movements of nature, as seen in the revolutions of planetary bodies; the ebb and flow of the sea; the fall of bodies to the earth; and all animal and mechanical motions. Also the velocity of sound, as witnessed in the firing of guns, and in thunder; and of light, as exemplified by calculation of the times of the eclipses of satellites, and even more remarkably in the aberration as discovered by Bradley. The *expansions* and *compressions* of bodies also, and *explosions*, as in gunpowder, must have, in each case, their own proper *times*, if we could accurately measure them.—In many cases nature is, as it were, prevented from producing her effects, for want of due time for her operations; the hand may be rapidly passed through flame without being burned; small vessels of water may be swung round in such a manner, vertically, as not to be spilled; and a ball fired across the axis of vision is not seen, because the motion is too rapid for the eye to be impressed by it.

One passage, which occurs under this head, is too remarkable to be omitted, as presenting an anticipation of the very examples we have just adduced, though commented on afterwards by the author in a doubtful manner. " Some cases have produced in me a suspicion altogether surprising; namely, whether the face of the serene and starry heavens be seen at the very time it exists, or not till some time later; and whether there be not, with regard to the light of the heavenly bodies, a *true* time and an *apparent* time, as well as a true place and an apparent place, according to the astronomer, on account of parallax; so

incredible does it seem that the rays of the celestial bodies can instantaneously pass to us, through such an immense space of miles, and not require even some considerable portion of time."

23. *Thirdly*, of the same class are the *Instantiæ Quanti*, instances of *quantity*, (literally, of how much.) These are cases in which the *virtues* or properties and effects of things are measured by the quantity of matter they contain. Examples adduced are that large collections of water do not easily become stagnant, like small ones; wines are matured and improved by being bottled off in small quantities; a magnet attracts more iron than any part of it when separated, though masses of all sizes as well as densities are equally attracted to the earth; sharp and angular points penetrate and divide bodies the most easily. The effects of *quantity*, therefore, Bacon observes, are to be carefully estimated. The importance of this to practice is obvious, if we name only chemistry and medicine.

28. The last of the four instances of measure are the *Instantiæ Luctæ;* instances of *resistance;* "which," says the author, "we also call *prevailing* instances; that is, such as show the subjection of *virtues* to one another; or which of them is the stronger and prevails, and which the weaker and submits; for the motions and struggles of bodies are no less compounded, recompounded, and complicate than bodies themselves."

In order to illustrate these *instantiæ luctæ*, Bacon introduces no less than *nineteen* kinds of *motion* (motus) or resistances, all differing, as he considers, from each other, and in their effects. He here, however, employs the word *motus* in a more general and less proper sense, than merely as signifying actual *change* of place; for in some of the cases nothing more is meant by it than certain *tendencies* in matter to resist certain external forces; thus his *Motus antitypiæ* he defines to be the resistance or repugnance which all bodies discover to the annihilation of their minute parts—it is, in short, the *indestructibility of matter;* a property which, so far as we are acquainted with nature, seems to be universal. Science may resolve matter into its component parts, or go far at least towards doing so; its form may be from the solid to the fluid, or the aëriform state; and it may combine into various ways with other matter; as may be seen in almost every chemical process, and in the dissolution of animal bodies after death: but only the Power that created matter can reduce it to nothing. To a careless observer, the fallen leaves of vegetables, which rot upon the ground, would appear to be lost for ever; but *Berthollet* has shown, by experiment, that whenever the soil becomes charged with such matter, the oxygen of the atmosphere combines with it, and converts it into carbonic acid gas. The consequence is, that this same carbon is absorbed by other vegetables, which it clothes with new foliage; these, in their turn, decay, and thus resolution and renovation go on to the end of time. In short, in the whole circle of the material world, we never witness a single instance of destruction or annihilation.

Bacon even enumerates, among these kinds of motion (motus), what is now called the *inertia* or *inactivity* of matter; a property by which it resists any change endeavoured to be made in its state, either of rest or motion; and which property is the foundation of the three *laws of motion*, as delivered by Newton in his *Principia*. Bacon singularly

calls it *Motus decubitûs*, aut *motus exhorrentiæ motûs*, the *motion* (tendency) *of repose*, or *of avoiding motion.* Among the kinds of motion, or tendency, mentioned as belonging to the *Instantiæ Luctæ*, are also the following:—

*Motus libertatis*, the motion of *liberty;* or, as our author means, *elasticity;* that property of bodies by which they restore themselves to their original figure, after compression; as is seen in the springs of watches; air in air-guns; Indian-rubber, etc.

*Motus hyles*, from a Greek word signifying matter, is the capacity of *expansion;* or the tendency of matter, under certain circumstances, to enlarge its bulk: the effect of *heat*, in expanding bodies; and gunpowder in explosions, are named as familiar examples.

*Motus continuationis*, or the attraction of *cohesion*, by which the particles of the same mass are kept together, as forming its component parts. The modern experiments on the strength of different substances, by finding what weights are necessary in order to tear them asunder, are founded on this property. These experiments have been made with bars of wood, metals, glass, etc., of given dimensions, and it has been found that the cohesive strength of a body is in the joint proportion of its elasticity, and toughness, and the area of its section. Newton conjectured *cohesion* in bodies to be that which constitutes them of different forms and properties.

*Motus indigentiæ*, the motion of *preference;* or the tendency which bodies have to unite with some bodies rather than with others. Thus the surface of mercury in a *glass* bottle appears *convex*, but in a metallic vessel, it appears *concave*, in consequence of its tendency to adhere to the sides of the vessel, as it has a greater attraction for metal than for glass. Chemical attraction, or affinity, also furnishes innumerable examples. Bacon seems to confound this *elective* attraction with *capillary* attraction; from which it differs as much as it does from the attraction of cohesion, or aggregate affinity.

*Motus congregationis majoris*, the motion of *greater aggregation*, or, if we may distinguish it from cohesion, in modern language, the *attraction* of *aggregation*, " is that," says Bacon, " by which bodies are carried to the masses of their own natures." This may be illustrated, if we carefully observe two small globules of mercury moved towards each other along a smooth surface: their mutual attraction will be evident immediately before they unite into one globule; or, if two pieces of cork be floated in a basin of water, not nearer to its edge than to each other, they will visibly approach, and at last come into contact.

*Motus fugæ*, or the *motion of avoidance*, though very crudely and almost ludicrously illustrated by Bacon, has its foundation in fact, and is that property of matter which is now called *repulsion.* Newton found that a convex *lens*, when put upon a flat glass, remained at the distance of the $\frac{1}{137}$th part of an inch; and that a very considerable force was requisite to diminish this distance. Again, though steel is so much heavier than its bulk of water, yet if a dry *needle* be placed carefully upon the surface of a basin of water, it will float; the repulsion of the water preventing its sinking. Also the particles of all *gases* seem to repel each other, as appears from their elasticity. According to Boscovich, the atoms of which bodies are composed are capable of acting on each other with a force, which differs in intensity, and in kind, according to

the distance. At sensible distances the force is *attractive*, and diminishes inversely as the squares of the distance. At the smallest distances the force is *repulsive;* it increases as the distance diminishes; and at last becomes infinite or insuperable. Hence if Boscovich's theory be correct, absolute contact, however paradoxical this may appear, is impossible. Facts, at all events, prove, in many cases, a repulsive power, whatever be its precise laws; and to these facts may be added, though somewhat differing from the former examples, the repulsion of electrified pith balls; also of the similar poles of two magnets. In the latter case, all the force of a strong man has proved insufficient to make the two north poles touch each other.

*Motus assimilationis* is the tendency of certain bodies "to convert other bodies related to them," says Bacon, "into their own substance and nature." He instances *flame*, which multiplies itself by decomposing certain substances; also animals, which seem to have a power of assimilating their food into the nature of their own bodies. However vague the notion of *assimilation* may be, Bacon's distinction here is sufficiently obvious.

To the above is subjoined *Motus excitationis*, or a tendency to *excite* and diffuse a quality. Thus *heat* diffuses itself when other bodies are heated; and the magnet gives to iron a new property without losing its own power. The distinction of this from the former *motion*, or property, lies in the circumstance of there being here no *transformation* of substances, but only a diffusion or multiplication of some virtue, or quality.

*Motus impressionis*, or the *motion of impression*, occurs where there seems to be a continual communication of impulses from the body which is the original source of it: the rays of light are an example, because darkness is the effect of the removal of a body from which they flow; also sounds, which cease if the vibrations of the sonorous body are suddenly stopped.

*Motus pertransitionis*, or *motion of passage*, has respect to the effect which the *medium* through which agencies are carried on, may have on promoting or hindering their power: thus *heat* is differently *conducted* by different bodies, or passes through them with various degrees of velocity; metals conduct it rapidly; earthy substances less so; and wood still more slowly. A ray of light, in passing from a rarer into a denser medium, as from air into water, becomes *refracted*, or is turned out of its course, and is bent towards the perpendicular. In an exhausted receiver, a bell can scarcely be heard to sound through the *attenuation* of the medium: and the experiments of Hauksbee and of Dr. Priestley show that, when the air is condensed, the sound is louder in proportion to the *condensation;* that is, in proportion to the quantity of air crowded in, and which operates as the medium of the sound, or the substance on which the vibration is first made, to be communicated through the atmosphere to our ear.

*Motus rotationis spontaneus*, the motion of *spontaneous rotation*, as seen in nature, is also mentioned; to which, says Bacon, belong the following considerations: the centre; the poles, or axis; the circumference; the velocity; the order, as from east to west, or west to east; the excentricity, if any, or deviation from circular motion; the declination, or the approach to, or recession from the poles; and

the variation of the poles themselves, if moveable, or, in modern language, *libration*.

The other species of *motus* introduced by Bacon, under the *Instantiæ Luctæ*, are somewhat more obscure and ill-defined. *Motus nexus*, or the motion of *connection*, seems to apply to those cases in which a *vacuum* is produced, and a fluid rises in consequence of the outward pressure being taken off, as in the common pumps and the barometer. *Motus minoris congregationis*, or the motion of *lesser aggregation*, is illustrated by the *cream* of milk floating on the surface, which Bacon attributes more to the attraction which homogeneous particles have for each other, than to the specific gravity of the cream being less than that of the milk.—*Motus magneticus*, or *magnetical* motion, is applied to the attraction of the heavenly bodies, from an idea, probably, that it might be a species of magnetism.—*Motus configurationis*, aut *situs*, motion of *configuration*, or *situation*, may apply to the shooting of *crystals* into their own peculiar forms; or to the fixed tendencies of bodies to preserve the disposition of their internal parts, as their threads and fibres, and their cellular or solid structures. Bacon singularly refers hither the inquiry into the direction of the celestial motions; also the polarity of the magnetic needle.—*Motus politicus*, or the motion of *government*, is excessively fanciful and obscure: it is said to be the ruling power, or property in any body, controlling all the rest, and it "*principally reigns in the spirits of animals.*" We should scarcely suspect Bacon of *materialism*, yet he seems to have been extremely disposed to introduce mechanical causes in order to account for effects which they are entirely insufficient to explain. *Motus trepidationis*, or the motion of *trepidation*, he illustrates by the hearts and pulses of animated beings.—This long dissertation on *motions*, whatever crudities and fancies it may contain, is very curious and interesting, and we have thought it worth while to analyse it briefly, as showing on what properties in nature our discriminating author founded his distinction of *Instantiæ Luctæ*.—This class of facts might be further illustrated, were it necessary, by the instruments used in England, by Cavendish, and in France by Coulomb, for experiments on *torsion;* a term employed by the latter philosopher to denote the effort made by a thread which has been twisted to untwist itself. These instruments, by means of the force of torsion, measure very small, and almost insensible actions.

The three remaining practical instances are termed *Instantiæ Propitiæ*, or instances *propitious* to practice, in the way of immediately directing, simplifying, and facilitating it.

(2.) *Instantiæ Propitiæ, Instances facilitating Practice.*

25. Of these, the *first* are the *Instantiæ innuentes, intimating or directing* instances; that is, those which tend to free practice from useless pursuits, and direct it chiefly to such as are beneficial and advantageous to mankind; such facts in nature and in experimental science as are worthy of being attended to and pursued, because they open direct prospects of usefulness and improvement, as it respects the arts and conveniences of life.

26. The *second* of this order, Bacon terms *Instantiæ Polychrestæ;* or things that are *generally useful*, as applicable to a great variety of

investigations, by shortening and facilitating the process. To this head belong the method of conducting experiments, and the instruments and apparatus to be employed in them, which he proposed to treat particularly in a subsequent part of his work. He here notices a few general considerations which are essential to practice in a great variety of cases.

In experiments, such things are carefully to be excluded as might *disturb*, or *modify* the given process; as the common *air*, where this can be supposed to have that effect; for the same end, the matter, strength and thickness of the *vessels* in which certain processes are carried on is to be attended to; also the manner of *closing* them where they are to be closed, as by luting, or hermetically sealing, for instance; the rays of the *sun* too must often be excluded. The effects of *compression*, *condensation*, *agitation*, *extension*, *rarefaction*, etc., are to be observed in many chemical and other processes. And here Bacon's conjecture must not be omitted, that it was possible "air might be converted into water by condensation." *M. Biot*, if we mistake not, first proved this conception of our great philosopher to be true, and succeeded in forming water from hydrogen and oxygen, by *compression* only, independently of the electric spark. To these considerations are to be added that of the agency of *heat* and *cold;* and the modification these may introduce into certain experiments; also the effect produced by the *medium* through which the heat may be communicated to any substances, by the structure of *furnaces*, and by the manner in which the fire may be *applied*. Again, regard is to be had to the effect which may be produced by a process being left to go on undisturbed, and by itself, for a longer or shorter *time*. The figure, position, and situation of the vessels that are employed, are to be considered. The *sympathies* and *antipathies* of bodies, as Bacon terms them, are to be noticed where these may have an influence; of these, chemical *affinities* and *elective* attractions are obvious instances. Lastly, advantage is to be taken of what is known with respect to all the above particulars, in order, by their means, to modify, combine, and vary experiments.

27. The *third* of the instances "*propitious*" to practice, and the last of the "*prerogative*" instances, are named *Instantiæ Magicæ*, *magical* instances; and Bacon understands by this term those facts in which great and wonderful effects are produced by apparently trifling causes. Nature, he observes, "is herself sparing in these instances;" but in harmony with the very sanguine, and we fear illusory expectations which we have seen he entertained, he adds, "what she may do, when further searched and entered into, and after the *discovery of forms*, *latent processes*, and *concealed structures*, will appear to posterity." He notices as *magical* or marvellous instances, the power of *fire* to multiply itself; the effect of *poisons* on the human frame; the communication and apparent *multiplication of motion* in a set of wheels, each impelling the other; the *loadstone* animating a number of needles without loss of its own magnetic power; the origination of *motion* in explosions of gunpowder, and also of gas in mines.

Tinctured somewhat, perhaps, with the wild notions of *alchemy* then prevailing, Bacon seems to augur from such facts as the above, that wonderful things may be accomplished by human power, in

"changing bodies in their smallest parts, and in all kinds of transformations." He adds, however, "of these we have hitherto no certain indications. And as in things solid, true, and useful, we aspire to the highest perfection; so we perpetually despise, and to the utmost of our power discard and reject such as are vain and empty."—Here ends the doctrine of "*Instances*" and all that was finished of the *Novum Organon* by its illustrious author.

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It was Lord Bacon's design, after treating of the *instances*, of which we have now given the analysis, to proceed to the *helps* of induction; the *rectification* of induction; the method of *varying* inquiries; the prerogative *natures* for inquiry; the *limits* of inquiry, in a list of *all the natures* in the universe; the reduction of inquiries to *practice*, or to the use of mankind; the *preliminaries* to inquiry; and the *scale of axioms*, or principles.

These eight last topics were deferred, probably, till the author had found time to accumulate more materials, and they were never discussed; so that his work was left in an unfinished state. Several of the particulars, however, here enumerated are not very distinct from some of the heads already treated of, and seem to lead us back over the same ground; whence we may conclude that Bacon was fully aware that, in the existing state of the knowledge of nature and fact, in his time, his system of philosophizing could only be regarded as a sort of outline, or sketch of scientific inquiry, and needed to be worked over and over again, by way of continual approximation to truth.

What more he had to deliver on these particulars we shall not now conjecture; but it may be remarked, that by *prerogative natures* for inquiry, he seems to have intended those causes in nature, or those agencies, which present themselves as of the most obvious and prime importance, in consequence of their involving, frequently, other inquiries: thus *temperature* is so important a consideration in various experiments, especially in chemistry, that *heat* may be considered as an example belonging to the class of what are here technically termed prerogative natures. The project of making an *inventory* (*synopsis*) of *all the natures* in the universe, appears to have arisen out of our author's very sanguine ideas, as before noticed, relative to the *discovery of forms.* If by *natures* he here means *simple substances*, or those which are incapable of being decomposed by art, it is obvious that such substances may decrease in number with the progress of science. Previously to Sir Humphry Davy's distinguished researches in chemistry, the simple bodies were supposed to be about fifty in number; the facts he has brought to light, however, make it difficult to say what substances, regarded as simple, may not be capable of analysis: witness this philosopher's discovery of the metallic bases of the fixed alkalis; his decomposition of most of the earths; and his experiments on sulphur and phosphorus: all these substances were previously thought to be strictly simple.

Though no direct attempt, so far as we are aware, has been made to supply the parts of the *Novum Organon* that are wanting; nor any complete logical system founded on the same basis of induction has been published, which might serve as a perfect directory in philosophical investigations; yet there have not been wanting some efforts of a similar kind, towards promoting the advancement of the sciences.

*Descartes* wrote a treatise expressly *De Methodo*, or the Method of Science, with the view of remedying the defects of the ancient plan of philosophizing, of which he seems to have been convinced. But though he flourished nearly half a century later than Bacon, and was acquainted with his writings, he pursued a course quite the contrary to that pointed out in the *Novum Organon;* which is the more singular, because, in one of his letters, he seems to acknowledge that if the experimental method of philosophizing were the true one, nothing could be superior to Bacon's rules. Descartes was anxious for a reform in the sciences; and, skilled as he was in mathematics, he was able by his genius to extend the limits of geometry as far beyond the place where he found them as Newton did after him; for he it was, principally, who developed the application of algebra to geometry, on which all modern mathematics rest; yet he was so misled by the humour of framing hypotheses, that his philosophical system is little more than an ingenious romance, and has long ceased even to be read as a matter of curiosity. In physical science, he seems never to have proposed to himself any thing like Bacon's plan of a strict *induction;* for though he did not reject experiment altogether from his philosophy, he employed it in the most loose and inefficient manner possible. He tells us that he was always able to discover *effects* by reasoning: "we employ experiment," he says, "not as a reason by which any thing is proved, for we wish to deduce effects from their causes, and not inversely, causes from their effects. We appeal to experience only, that out of innumerable effects which may be produced from the same cause, we may direct our attention to one rather than another." How different this from the tone of the very first sentence of the *Novum Organon*—MAN, THE SERVANT AND INTERPRETER OF NATURE, UNDERSTANDS AND REDUCES TO PRACTICE JUST SO MUCH AS HE HAS ACTUALLY EXPERIENCED OF NATURE'S LAWS; MORE HE CAN NEITHER KNOW NOR ACHIEVE.

It is evident that such a mode of philosophizing as this was precisely the reverse of Bacon's. Instead of proceeding upwards from effects to causes, or, as Bacon would term it, *raising axioms* from particular instances, Descartes proceeded directly in the contrary order, from causes to effects, or from generals to particulars; and this without having previously established his general conclusions in a scientific manner, or received sufficient evidence that they could be properly applied to the given particular cases. In this way he proposed to explain all the phenomena of the universe *à priori*, that is, by deducing them from his general principles by abstract reasoning; and instead of the patient caution which generally distinguished Bacon's vast analogical powers, Descartes, while he sets out with a scepticism so universal as even to make him not admit his own existence till he has attempted to prove it, at the same time exhibits, in his theories, the most unphilosophical credulity and rashness. Hence, though he certainly has the merit of great original genius in pure mathematics, his physical speculations produced the hypothesis of a *plenum* and *vortices;* or that the planetary bodies are whirled round by a subtile matter of which the universe is full; an hypothesis which, it scarcely needs be remarked, was equally applicable to all the systems of astronomy, whether that of Ptolemy, Tycho, or Copernicus; and rested upon the assumption of motions not proved to exist; or even if they did exist, just as

much needing inquiry and explanation as those they are called on to solve.

*M. Tschirnhausen*, a member of the Royal Academy of Sciences, at Paris, published, in 1687, an essay, entitled *Medicina Mentis, sive Tentamen genuinæ Logicæ*, "Assistance to the Understanding, or an Attempt towards a genuine Logic; in which is discussed the Art of finding general Principles, and the method of discovering unknown Truths." This work, which discovers much ingenuity, is not, however, adapted to practice; and may be regarded as illustrating Lord Bacon's caution in the first book of the *Novum Organon*, with respect to the influence which particular studies may have in biassing the mind in its inquiries after truth. M. Tschiruhausen, reflecting on the little controversy there is among mathematicians, compared with the disputes among students in other branches of science, considered that a method strictly mathematical might be applied with effect to these other branches. Hence he thought that unknown truths might be discovered precisely in the same manner in every science, as in pure mathematics. He even fancies that the difference between the "perceptions of the imagination," as he terms the notions we form of things by sensation merely, and the "conceptions of the understanding," such as that a whole is greater than a part, may come under mathematical calculation! In short, by natural philosophy, Tschirnhausen seems to understand something not very different from Descartes' notion of it above mentioned, namely, a knowledge of the universe demonstrated *à priori* in mathematical order, and confirmed *à posteriori* by experiments.

At an earlier period, the *Hon. Robert Boyle* ably seconded and practically improved the plan of experimental philosophy. This distinguished man, who was born the year Bacon died, was among the first originators of the Royal Society; which was formed, in 1645, for the purpose of improving experimental knowledge on the plan laid down by Bacon. Boyle's valuable experiments in various branches of science show that he had deeply imbibed the spirit of his great master's system; and, independently of his discoveries and improvements, they constitute a most important addition to what Bacon had so loudly called on philosophers to labour at obtaining; namely, a more extensive and accurate history of nature. Many of Boyle's essays contain remarks on the method of pursuing the inquiries of science, highly calculated to facilitate and promote the grand object which Bacon pointed out, and to familiarize to philosophers the practice of an enlightened induction.

*Dr. Hooke*, contemporary of Boyle, a man of great mechanical science, who laid claim to several useful inventions and discoveries, and whose fame is much less than his deserts, partly because he was eclipsed by Newton, and partly because he wearied men with his inordinate pretensions, seems to have formally designed an attempt of a similar kind with Bacon's. He entitles his work "The true Method of building a solid Philosophy; or a *Philosophical Algebra*." "This," he says, consists of two parts: first, the manner of preparing the mind, and furnishing it with fit materials to work on; secondly, the rules and methods of proceeding, or operating with this so collected and qualified *supellex*." All that Dr. Hooke has left us of this posthumous piece, is little more than what Bacon has sketched in the first book of the

*Novum Organon*. The second part seems never to have been written, so that what the "Philosophical Algebra" was precisely to have been, must be left to conjecture.

We may safely assert, that whatever more may hereafter be done in the way of rules for scientific inquiries, can only proceed on the plan of Bacon, as the groundwork: for the method of induction is founded on the principles of human nature itself; and only needed to be fairly presented to the minds of men, generally, in order to command their approbation and support. Not, indeed, that the inductive method, as we may here take the opportunity of observing, is properly to be considered as *opposed* to the syllogistic, in which light it has been the fashion to represent it. Induction is not a distinct kind of argument from the syllogism adopted by Aristotle; that is, if by induction we understand as we ought to do, and as Bacon understands it, not merely the process of investigation, and of collecting facts, but also the deduction of *inferences* from these facts. This deduction is, of course, an argumentative process, capable, if necessary, which is, perhaps, scarcely ever strictly the case, of being put into a syllogistic form; for a syllogism is nothing more than any argument whatever, stated in order, technically, and at full length; it is an expansion of the assertions that are implied and contained in the propositions with which we commenced; and it points out the complete force of what has already been virtually admitted. The fault of the Schoolmen lay in reasoning from *false premises*, that is, in drawing conclusions from insufficient *data;* and in employing the syllogism for the purpose of making discoveries in natural science, without instituting sound philosophical inquiries.

If the real merit of a system is to be estimated by its actual effects, Bacon's *Organon*, and some of his other philosophical writings, must be reckoned among the fairest fruits which the genius of man has bequeathed to his fellows. Let the whole spirit and manner of the writings of such men as *Boyle*, *Hooke*, and *Locke*, who were Bacon's almost immediate successors, be compared with the method of those who preceded him, and it will be impossible not to perceive the commanding influence of Bacon's labours, and the very distinct character they impressed on the next age. Even Newton's incomparable genius might never have awoke to all its strength, unless Bacon had previously cleared the theatre where it was to act, and made a way for the free exercise of its energies, by removing the chief obstructions to its mighty career. The indications and the germ of several of Newton's discoveries are certainly to be detected in Bacon's works; and had Newton been born a century earlier, instead of beginning where Bacon left off, and standing on the vantage-ground reared by his labours, the world might have lost many of the most important advantages he has been able to confer on it, by means of the experimental method. Bacon scattered away the darkness of error from that horizon in which Newton was afterwards to appear, or Newton might never have had power to soar as he did into the third heavens of truth, and to pour such a flood of light over the whole field of natural science, as to excite the admiration and astonishment of his own and all succeeding ages.

Though the triumph of truth over error seems always destined to be a gradual process, it is a well-known fact that Lord Bacon's philosophical writings did not fail to make a very early impression

on the learned world, both at home and abroad. The University of Oxford presented an address to him in 1623, in which he is represented "as a mighty *Hercules*, who had by his own hand greatly advanced those pillars in the learned world, which by the rest of the world were supposed immoveable." This tribute to Bacon's merit as a philosopher has the greater weight, because it was offered, as *Macvey Napier* remarks, "when all motives to interested adulation had been done away by his lamentable fall."

The Baconian philosophy seems, afterwards, to have made greater progress at Cambridge than at Oxford, notwithstanding the above testimony from the latter University to the genius of its author. "*Glanvil* lamented," says *Anthony Wood*, "that his friends did not send him to Cambridge; because he used to say, that the new philosophy, and the art of philosophizing, were more cultivated there than here at Oxford." This was about the year 1652;—Lord Bacon died in 1626. That the spirit of free inquiry in which the *Royal Society* originated, was chiefly owing to the effect of Bacon's writings cannot be disputed. For information on this subject it is sufficient to consult *Bishop Sprat's* History of the Royal Society, and *Dr. John Wallis's* account of his own life. A host of other authorities might be accumulated, were it necessary, in proof of the direct and early influence of Bacon's writings in forming the new English school; of these testimonies a great variety are collected in *Napier's* masterly tract, entitled, "Remarks Illustrative of the Scope and Influence of the Philosophical Writings of Lord Bacon."

On the continent of Europe, his philosophical reputation was early acknowledged. *Dr. Rawley* says that "his fame was greater, and sounded louder in foreign parts than at home;" and that "divers of his works had been translated, more than once, into other tongues, both learned and modern, by foreign pens." In 1652, *Lewis Elzevir* was about to publish Lord Bacon's works in Holland, as writings "long received with the most attested applause of the learned world." *Gassendi*, a strenuous opponent of the philosophy of Aristotle, and of that of Descartes, was one of Bacon's earliest disciples in France, being born in 1592. Bacon's correspondence with *Baranzan* proves how early his writings had attracted notice in Italy. We might add the testimony of *Commenius*, in Germany, so early as 1643, together with those of a number of other philosophers quoted at length by Mr. Napier, all showing that the revival of science, not only in England, but on the continent, is mainly to be traced to the effect of Bacon's writings, and this at no distant period from their publication.

That the labours of our illustrious philosopher should have excited jealousy and alarm in some quarters, and especially among those who were still devoted to Aristotle, is what we were quite prepared to expect. Error and party interest shun the light, and are ever ready to brand all attempts at improvement with the name of dangerous innovation. Perhaps no great endeavour for the welfare of mankind ever escaped this doom, or failed to rouse the tocsin of alarm. A hue and cry was accordingly soon raised against the New Philosophy, and a keen pursuit kept up, with the laudable view, if possible, of putting it down. The *Novum Organon* is now considered harmless enough surely; and in modern times, it has been permitted to slumber be-

tween its covers pretty much unmolested by the majority of mankind, who little know how greatly they are indebted to it for the effect it has had towards producing many of the arts and conveniences of life; but time was, when it was necessary to allay men's fears and jealousies of its doctrines having a sort of magic power to produce "dangerous revolutions," "subvert" governments, and overturn the authority of religion. Such, at an early period, were the alarms of not a few, and among the rest, of *Dr. Henry Stubbe*, who denounced the whole tribe of Experimentalists, with the singularly happy and courteous epithet of a "*Bacon-faced generation;*" and after informing us, in great simplicity, that he has "small regard for deep and subtle inquiries into natural philosophy," says, that "we must rise as high in our resentments" against the said generation, "as the concerns of the present age and of posterity can animate us."

So malignant an aspect, in short, did some imagine Bacon's writings to have on what are infinitely the most important interests of the human race, that *he* was shrewdly suspected of favouring *atheism*, who had eloquently published to the world, "I would rather believe all the fables in the Legend, and the Talmud, and the Alcoran, than that this universal frame is without a mind." We should have supposed that any kind of tendency to irreligion would have been the very last thing that could be imputed to Bacon's works;—but such is prejudice. It is, in fact, a happy circumstance for mankind, that geniuses the most transcendant and original that ever lighted upon our world, who have thirsted the most ardently for knowledge, and have vindicated most boldly the freedom of the human mind from every yoke but that of truth, have been the farthest from meriting such a charge, in the writings they have left us. Such were Newton, and Bacon, and Milton, and Locke.

Though we have given the *analysis* of Bacon's great work, not merely as deeming it a curiosity in the history of science, but as tending to recal our attention towards principles to which we owe so much, and the study of which we should be sorry ever to see neglected as superfluous; yet we are free to acknowledge that the whole process, according to the detail which our great philosopher recommends, was strictly necessary in practice, chiefly in the infancy of science; or, where the subject of inquiry is altogether new, and one of which we have little or no knowledge. The world, as to its improvement in science, may, in some degree, be compared to an individual. The proficient in the art of music has no need to recollect at every step the names of the notes in the *gamut*, or the rules he has been taught for fingering the keys; nor would this be possible: when he has once acquired dexterity in music as an art, theory is converted into a true, though mechanical kind of practice: so now that science has made certain advances, and has established a series of truths, it may often be quite unnecessary to go through the whole process of *induction* from the beginning. After certain general and leading principles have been completely authenticated, these may serve greatly to shorten future inquiries, and much time and labour may of course be saved. Thus, after the laws of the reflexion, and the different refrangibility of light, and the nature of the colours which refraction produces, had been satisfactorily ascertained by experiment, Newton had the ma-

terials prepared for explaining the rainbow, nor was it necessary again to institute an inquiry respecting the above laws, as if they were unknown. Newton's Optics, it may here be remarked, may justly be regarded as a most perfect specimen of the *Baconian Induction.* Dr. Black's Treatise on Magnesia Alba and Quicklime, is also an excellent model of the inductive method, affording similar examples of safely proceeding to further conclusions by assuming things well known.

It must be allowed, also, that, in addition to the effect produced by the collection of facts, and composing a history of nature, and by long practice in the experimental method, inductive investigation has been more modified in some inquiries, by the employment of *mathematical reasoning*, than Bacon, who had not pursued mathematical studies, was prepared to expect. Though he pointed out the use of mathematics, in measuring and comparing the objects of natural philosophy, he was not, nor could he be, aware to what extent geometry and analysis would be applied, in generalising inquiries, and in rendering experiment in some cases less necessary. The laws of motion, for instance, are founded, of course, on experience; but from these laws, once established, the rest of the science of mechanics is chiefly deduced by reasoning. So also in optics, when a ray of light is refracted, or bent from a straight line, as when it passes from air into water, the angle which the refracted ray makes with the surface depends on that which the incident ray makes with it; and we must ascertain by experiment what angle of refraction corresponds to any given angle of incidence; but we must have recourse to geometry if we would know the constant relation which subsists between these angles, and be able to express this relation in general terms applicable to all cases, for, with regard to this, experiment does not directly inform us. But the great triumph of mathematics, as applied to physics, and which Bacon never could have believed possible, has been the discovery of certain phenomena in the planetary motions, never suspected until the sublime discovery of modern analysis indicated those appearances as cases of the general rule.

Perhaps Bacon, moreover, in his zeal against the visionary philosophy of the ancients, scarcely allowed, in his inductive theory, the use which, in some cases, even *hypothesis* may be of in assisting our inquiries. Newton employs almost in the manner of a motto, the expression '*hypotheses non fingo*,' *I do not devise hypotheses.* He might here allude to such hypotheses as the *vortices* of Des Cartes; for he himself, in some cases, used hypothesis. In a subordinate sense of the term, and, indeed, to a limited extent, it frequently appears necessary to do so. Newton's theory of gravitation took its rise from a conjecture suggested by *analogy*; and was afterwards verified by comparing the moon's revolution in her orbit, with the law of accelerated velocity, as exhibited in falling bodies near the earth's surface. Copernicus, in the same manner, was led by *analogy* to the true system of the universe, and the only evidence he could offer in its favour was its *simplicity*. This hypothesis of Copernicus, in the hands of Newton became an established fact. Indeed, in many cases of physical investigation, there is nothing before the mind for it to act on, but two or three different hypotheses, which it is the business of a strict induction to judge of, and to adopt that which most accords with the facts.

Hypotheses become dangerous only when they are admitted as *theories*, and when, instead of being employed as a temporary guide, stimulating the mind of the inquirer to observation and experiment, they are set up as substitutes for facts, and become idols of the imagination, before which reason is to bow. It was in this view that Bacon so loudly condemned them, while it must be acknowledged that he scarcely provided for a cautious and enlightened use of them. "Any hypothesis," as Dr. Hartley well observes, "which possesses a sufficient degree of plausibility to account for a number of facts, helps us to digest these facts, to bring new ones to light, and to make *experimenta crucis* for the benefit of future inquirers."

Whatever defects or redundancies, however, the triumph of the Baconian method for two centuries has enabled us to perceive in the writings of its distinguished author, we cannot look on what he has actually done for science but with surprise and admiration. No one before him seems thoroughly to have been possessed with the idea of the folly of supposing a being of such imperfect and limited faculties as man capable of explaining nature's laws and operations by means of reasonings *à priori*. If there are beings to whom this is given, it is certainly denied to man; and the grand lesson which Bacon taught the world was, that all false philosophy might be traced to a mistake as to the real powers of the human mind, and the proper direction in which, from its nature and present condition, it must always submit to act, in the acquisition of knowledge. It had in general sought to attain to truth by eccentric movements and forced marches, while the only method suited to its capacities was looked on with contempt or disregard—that of simply feeling its way out of darkness into light. That Bacon probably overrated the effects of the inductive method, we have already remarked; this, however, was a very different thing from the ancient error of supposing the mind capable of inventing true theories without the labour of experience. It is certain that Bacon believed it within the limit of possibility to transmute other substances into gold; and on this account he has been identified with the disciples of *Raymond Lully* and *Jordano Bruno*. No one, however, could be more sensible than himself of the general folly of the pursuits of the alchemists; and his belief in *transmutation* arose out of his sanguine ideas of the resources of the inductive method—resources as yet untried and unknown; for we may venture to say that, in his time, there was not a sufficient collection of facts and experiments to authorise the conclusion that even the *essences* of different substances might not hereafter be discovered, when the new philosophy, then only in its infancy, should be matured. Time indeed has not fulfilled these anticipations, but Bacon's speculation with regard to transmutation was entertained after him by Boyle and others; and there is evidence that it was not decidedly opposed even by Newton himself.

The study of Bacon's philosophical works in general, and especially of the *Novum Organon*, cannot fail to be highly beneficial to all persons who are entering on scientific pursuits, and to all who are engaged in inquiries after truth of whatever kind. Their general tendency will be, if we do not greatly err, to inspire a habit of close and patient thinking,—an intellectual independence, which resists all that is merely of the nature of hypothesis, while it bows with implicit

deference to the authority of fact and experience. The nature of the different kinds of evidence; the different subjects to which they are properly applicable; the degree of that sort of evidence that is called moral, which it is reasonable to expect in any given case; the proper limits both of doubt and of belief; the whole order of circumstances of whatever kind that may have any bearing on the impression which evidence may make, or may fail to make, on the mind;—these very interesting topics of inquiry, as well as every other subject relating to moral and intellectual philosophy, are not less properly and strictly within the sphere of the operation of the Baconian method, than the more tangible properties of matter itself, and the laws of the material universe in general. The spirit of the inductive philosophy is in perfect unison with man's intellectual nature; it offers a true corroborative to his faculties in his pursuit of truth; and the more completely this spirit is imbibed, the more shall we be guarded from the extremes of credulity on the one hand, and incredulity on the other.

Bacon's style has been condemned as "stiff and rigid;" and his wit as "often unnatural and far-fetched." He certainly employs, to a considerable degree, the quaint and highly figurative diction which was the fashion of his time. Of this we have remarkable specimens in many of his divisions in treating the doctrine of "*Instances;*" notwithstanding this, however, his style is not so often chargeable with vagueness or obscurity as might be supposed. When it is, this arises usually from his not defining his terms, from his adopting the old scholastic words and phrases with a new meaning, and employing the same word in different senses. His rich, prophetic imagination led him to the use of a lofty and poetic diction, which, though it may not altogether approve itself to a severe and philosophical criticism, often clothes his conceptions with singular beauty, embodies them to the imagination in forms of commanding energy, and impresses them deeply on the mind. His latinity in the *Novum Organon* is not to be despised; though he necessarily uses words and adopts meanings which are not to be found in the authors of classical antiquity: the subject on which he writes was new to the learned world, and he was evidently more solicitous to make himself understood, than to attain to the Augustan purity of the Roman idiom, or discourse in the music of its cadences, as we find them in Cicero's philosophical writings.

In closing this Treatise we may safely affirm, that, by giving the Inductive Philosophy to the world, Lord Bacon has proved one of its most signal benefactors; and has largely done his part towards promoting the final triumph of all truth, whether natural, or moral and intellectual, over all error; and towards bringing on that glorious crisis, destined, we doubt not, one day to arrive, when, according to the allegorical representation of that great poet who was not only the admirer of Bacon, but in some respect his kindred genius—TRUTH, though "hewn, like the mangled body of Osiris, into a thousand pieces, and scattered to the four winds, shall be gathered limb to limb, and moulded, with every joint and member, into an immortal feature of loveliness and perfection."